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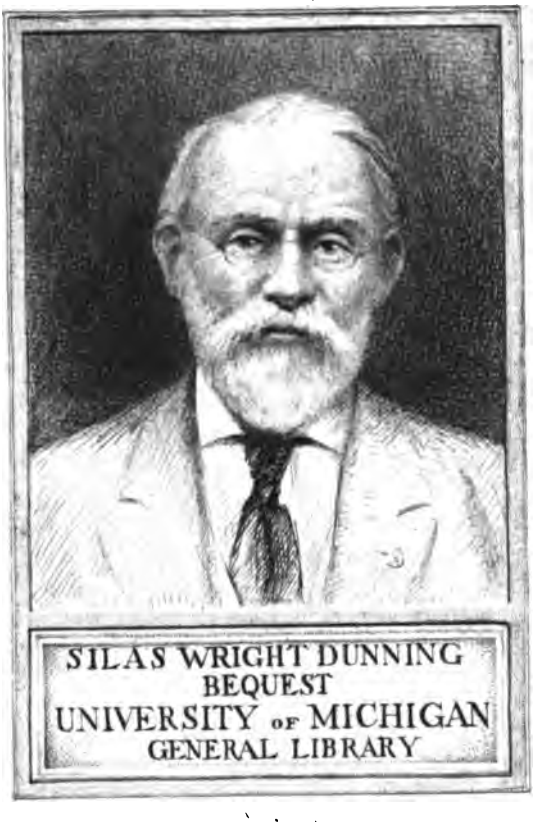
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1½ inches in girth at their thickest, and from 6 to 8 feet in length according to the depth of the water in which they grow: they seldom rise higher than from 2 to 2½ above the surface, but elongate themselves to this extent even when the water is at its deepest.

The Lotus leaves begin to shew themselves early in March, mostly around the margins of nearly dried up tanks, pools, and lakes. The stalk of the leaf is at first, seldom more than a few inches in length. The root runs along in long white stems about the thickness of the little finger, throwing out dark brown bunches of rootlets from 3 to 4 inches long every two or three feet (Pl. I. Fig. 1). These anchor themselves firmly into the ground near the surface till the water is reached. The root stem then sweeps along, floating near the surface for many yards at a stretch, throwing off double branches at each joint, and so speedily covering the whole extent of the lake. Every joint gives off three new shoots: one forms a leaf, and two go on to the right and left, doubling once more at the next rooting place. The stalk is full of air and very buoyant;—so soon as the plant desires to anchor itself once more in the ground, it sends off a heavy dense shoot, which on reaching the bottom gives off rootlets which, when fairly fixed, allow the stem of the leaf or flower to re-ascend. It is only from those joints which have fastened themselves firmly to the ground, that leaves rising above the water, and not depending on floatage for stability, or flowers, are thrown off. At first the leaves float upon the water; and two-thirds of them at least so continue, forming an uniform bright green covering over the surface, completely hiding all beneath; a third or fourth rise up on stalks from 18 to 24 inches above the surface, the height to which the flower-stalks themselves ascend. A tank covered with Lotuses, in flower presents a spectacle of the most singular beauty. The leaf has the power of throwing off the little ripple raised by the water; this shews in the hollow of the leaves like gigantic drops of dew or masses of pearl. The leaf is buoyant enough to support a crow, and is frequently made use of by that bird as a fishing station, from which flies, snails or water lizards are preyed upon. The natives use them continually in place of plates or dishes, from which they eat their food (Pl. II. Fig 4).

The flower has something of the smell of the Tonquin bean, or of the common bean blossom.

*The Internal structure of the Root, Flower, and Leaf Stems* is nearly the same in all, with this difference—that the former two have mostly 7 or 9 large air tubes, as figured in the diagram, and 15 or 20 small ones. The leaf-stalk has four large air tubes, of which one pair is much wider than the other, and eight or ten small ones. The root when sliced across is nearly white—the leaf and flower stems palish green, beautifully freckled with points of darker

green or greenish brown. Externally both sets of stems are covered over with a thick skin, abounding in hairy prickles.

SECTIONS. NATURAL SIZE.

Of Root.

Of Flower Stalk.

Of Leaf Stalk.

The air tubes extend along the whole length of the stem from the root to the leaf or flower, or from one joint of the root to another, with certain striking distinctions by and bye to be described. Where the root occurs they terminate suddenly, the whole mass for a couple of inches or so being occupied by an interlacement of woody fibres, with intervals between, which are filled up with a congeries of minute cells filled with particles of starch.

The dark brown feathery fibres of the roots are frequently from one to four or five inches in length (Pl. I. Fig. 1).

When the stalk is cut across, a copious efflux of a milky fluid makes its appearance, apparently from the ruptured cells, and continues to flow for some seconds. If the stalk be broken, and not cut, and the separated portions drawn gently away from each other, a set of beautiful transparent films, thirty or forty in number, like the fine spun threads of a spider's web, make their appearance, and may be extended for 6 or 8 inches without breaking. A pocket magnifier will shew these to be spirals—under a glass of moderate power, they are developed into beautiful coils of blonde-ribbon-looking tissue (Pl. IV). The spirals seem to occupy a series of lacteals or milch tubes filled with milk, and when drawn carefully out, little globules of this adhere to them. They appear to wind round and line the interior of these tubes like a ribbon. Spirals abound in every part of the plant: the roots and stems are full of them, and scarcely any portion of the leaf can be torn, in which they do not make their appearance in profusion. They seem nearly all of the same size, form, and structure.

The large tubes themselves never contain water, or any visible fluid, but are at all times filled from end to end with air. All the tubes are cut across by thin septa, at intervals of from five to six inches, no two tubes ever being so interrupted at the same place. The septa are formed of a rich network, the spaces being triangular—a small swelling is observed at each junction point of the netting, the spaces between which are occupied by a thin transparent, apparently water-tight membrane, which the slightest pressure is sufficient to burst. The diaphragm is supported apparently by a series of

over them, by the reflecting light from its under surface, shews the area over which the air is emanating, the form it is assuming as it grows in volume, when increasing in depth from the crest down till it becomes detached in the shape of bubbles, disengage themselves, and rising to the surface. From 15 to 30 seconds is usually occupied in this, and the bubbles rise promiscuously, commonly at intervals of two or three inches from each other over the whole surface of the leaf. I have endeavoured to ascertain whether there be any particular circumstances or specific time when respiration goes on with greater or less activity, but have been unable to arrive at any trustworthy conclusion on the subject: —it *seemed* more active about two hours after sunrise —least so in the evening. I have not managed to collect the air respired from the surface of the leaf, but have obtained it in abundance from the leaf-stalks freshly cut across. From this it rushes out for days on end in a continuous succession of bubbles, which obviously come from the larger air-vessels, and are in volume proportioned to the size of the apertures from which they emanate. These air vessels, as already observed, have no direct visible communication with the water or atmosphere anywhere: they are cut across half a dozen of times at least by septa, and are entirely closed up at the root joints. Yet the vast volume of air discharged by them must either have been extricated directly from the water, or be the produce of the respiration which I have supposed possible through the lower portion of the leaf.

The phenomenon is peculiarly manifest where the leaf continues healthy and strong, while some one or more of the air vessels have become eaten through by the little water snails (*Pauladinæ*), which browse on them with such avidity. In this case it continues rising for hours in a continuous rush of bubbles. These proceed from the larger vessels alone, all of which on reaching the leaf pass on to a complex air chamber in its upper surface, from which numberless vessels are seen to extend themselves in all directions through the leaf. These doubtless afford those air bubbles, to be seen in such abundance when the leaf is itself submerged under or covered with water. Just within the outer coating of the leaf-stalk are systyms of vessels, around the inner circuit the stalk filled with milk, and each provided with a spiral. As the lower side of the leaf is neared, a portion of these expand themselves into air tubes, and in this fashion enter the ribs of the leaf—a portion of them enter, but do not alter or expand, apparently feeding the leaf with milk. This is to be met with in abundance wherever it is cut, especially so, near the centre. Each rib contains two large air ducts or channels, affording a triangular section, as represented in the diagram (Fig 14). They contain air only, of what description I am not aware. However often the main ribs branch off, the double channel is maintained both in the principal and secondary, and in both

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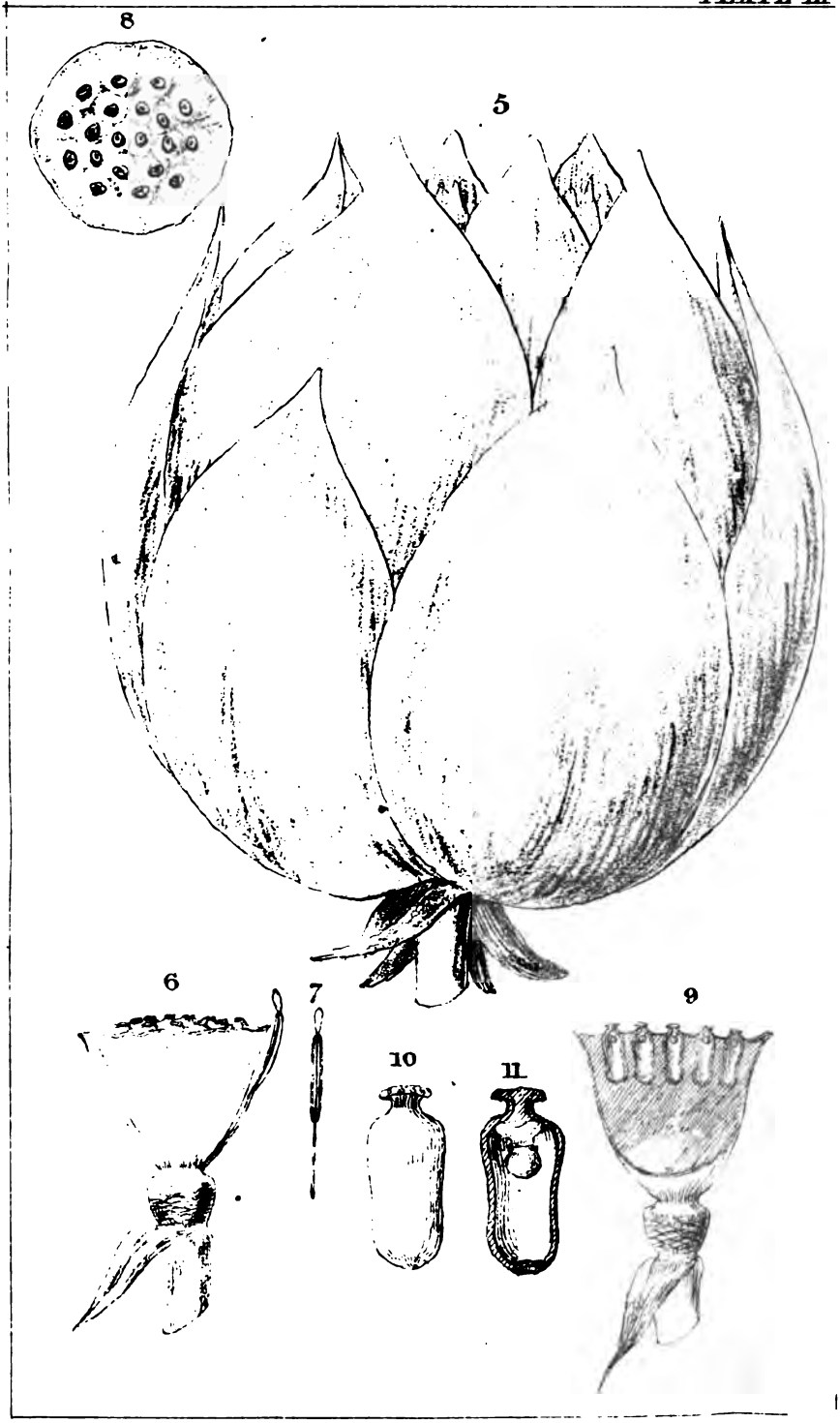
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The following is from *Forbes' Oriental Memoirs*, Vol. III, p. 286 and 362 :—

"I do not know whether the seed of the lotos is eaten, or put to any other use in India, nor can I ascertain the variety of these plants in different parts. Eustathius says there are many kinds of lotos : he thinks Homer speaks of it as an herb, for he calls it ἄνθινον εἶδαρ ; and adds, that there is an Egyptian lotos, which Herodotus affirms grows abundantly in the Nile, resembling a lily ; the Egyptians take out the pulp or seed, dry it in the sun, and bake it as bread: this I think cannot be any of the class in Hindostan. Athenæus, in his Deipnosophist, quotes a description of the Lybian lotos, from Polybius, which was used as food by the natives ; but that also differs very much from the lily of the Nile, or the nymphea of Hindostan. Did any of the harmless Hindoos eat the seed or fruit of this plant, as they convert its leaves into dishes and plates at their own vegetable meals, they would exactly answer Homer's description of the innocent lotophagi.

'At length we touch'd, by storms and tempests tost,
'The land of *Lotos*, and flowery coast;
'We climb'd the beach, and springs of water found,
'Then spread our frugal banquet on the ground :
'The people there are kind to foreign guest,
'They eat, they drink, and nature gives the feast;
'The trees around them all their food produce,
'Lotos the name ; divine nectareous juice !
'(Thence call'd lotophagi) which whoso tastes,
'Insatiate riots in the sweet repast.'" ODYSSEY.—*Vol. III, p. 286.*

"I have often mentioned this lovely flower ; the intelligent Mr. Knight throws a new light upon the subject : 'growing in the water, amongst its broad leaves it puts forth a flower, in the centre of which is formed the seed-vessel, shaped like a bell, or inverted cone, and punctuated on the top with little cavities, or cells, in which the seeds grow to maturity, decay, and again shoot forth ; for the orifices of these cells being too small to let the seeds drop out when ripe, new plants germinate in the places where they were formed, the bulb of the vessel serving as a matrice to nourish them until they acquire such a degree of magnitude as to burst it open and release themselves ; after which, like other aquatic weeds, they take root wherever the current deposits them. This plant, therefore, being thus productive of itself, and vegetating from its own matrice without being fostered in the earth, was naturally adopted as the symbol of the productive power of the Deity upon the waters.' To this Maurice alludes in his beautiful poem on the lotos of Egypt.

'Within thy fair corolla's full-blown bell
Long since th' immortals fix'd their fond abode;
There day's bright source, Osiris, lov'd to dwell,
While by his side enamour'd Isis glow'd.

What mystic treasures in thy form conceal'd,
Perpetual transport to the sage supply ;
Where Nature, in her deep designs reveal'd,
Awes wondering man, and charms th' exploring eye.

In thy prolific vase, and fertile seeds,
Are trac'd her grand regenerative powers ;
Life, springing warm, from loath'd putrescence breeds,
And lovelier germs shoot forth, and lovelier flowers.'"—*Vol. III, p. 362.*

## ART. II.—*Notes on a Journey through part of Kattiawar and Goozerat in Jan.* 1855. By DR. GEORGE BUIST.

[Laid before the Society 15th March, 1855.]

IN presenting the following notes to the Society, it may be as well to premise, that though the districts traversed are in our immediate neighbourhood and have so long been familiar to us, that there might seem little to be seen in them requiring to be described which had not been so before, I found them so full of matters of interest never touched on by any one, that I could have supposed myself in the wastes of Africa or wilds of the Himmalayas, rather than in regions not 400 miles from the presidency, and which had for nearly half a century been in a great measure in English hands. As qualifying this, it is proper to add, that my impressions were those of a Griffin of the purest sort; and that though most parts of the presidency were as familiar to me as books, letters and conversation could well make them, all my knowledge of it was derived from secondary sources. The duties of a laborious profession had kept me chained to the Island during nearly the entire fourteen years of my residence in India; and though from 1840 within sight of the mainland, I had in reality never been a score of miles from my office, excepting on a few transient occasions when my own sickness, or that of my family, compelled a hurried change of air and scene—to Poonah, Mahabuleshwur, or Surat, under circumstances as unsuitable as might be for enjoyment or observation. The delight felt by one devoted to travel, and who seemed destined to close his connection with India before he had so much as had a look of it, may be imagined, when circumstances arose in the end of 1854 affording the hope of an excursion from which the utmost gratification was looked for, and as it turned out—not in vain.

My observations from first to last are to be received as those of a Griffin on his first journey, to whom many things perfectly familiar "TO OLD INDIANS" appeared new, and where astonishment may have been created by what more experienced men would have passed unmoved.

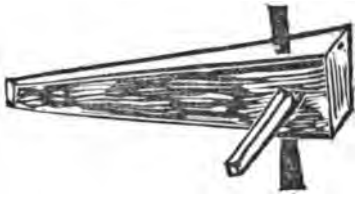
I have generally found instruments and books, even though the bulk of these might afterwards prove superfluous, so much of a conveniency and possible source of enlightenment, that I have throughout my limited wanderings indulged more in an excess of this variety of lumber than in that ordinarily preferred, and not unfrequently deemed essential by Indian travellers, and now provided myself with an abundant supply.*

* I took three sets of Thermometers, three Barometers—one of which was proposed to be left at Broach. It was wished to leave the party desiring them a choice; one Barometer would otherwise have sufficed. A Daniell's Hygrometer. A Prismatic Compass. Common

rate height, is a fort of very much the appearance of those of Mahim, Sewree, Sion and Worlee, but somewhat larger in point of size. There seems no date inscribed on it: from its aspect it might at first sight have been supposed of the age of those just named, but they were built by the English about the year 1700;—we in reality had no buildings beyond Mahim for eighty years after this. Besides, the fort of Versova contains a Church, and a place of worship is generally the last thing an Englishman thinks of in India: the theatre, racket court, ball-room, and race course, come first—churches are built when there is nothing else to be done, and people would rather hear a sermon than be idle. About forty years ago Versova was the training place for Cadets, after Old Woman's Island or little Colaba, and afterwards Mahim College had been abandoned; a party of Artillery, and afterwards of Sappers and Miners, from 1800 to 1804 were stationed at Versova: there are still some remains of the quarters they occupied. The side wall of a handsome house,—a flight of steps, still in good preservation, leading to a platform which commands one of the most beautiful views that can be imagined,—indicate where the commanding officer once dwelt: but the walls have been mostly built with mud and stone, only *pointed* with chunam. That most magnificent of architects, the Banian tree—which in itself furnishes forth a temple, a camp, or a caravanserai, and, as if in rivalry, rends to pieces all structures reared by human hands—had fixed its fangs in every crevice, tearing the most solid walls as if in sport asunder. The view from this shows how little way the voyager has got from Bombay. Just across by Mahim is Neats Tongue, apparently scarce ten miles off: along the coast Nossa Senhora de Monte is conspicuous, Worlee Fort, Love-Grove, the Temple of Mahaluximee, Tardeo and Malabar Hills are all in view. On the other side the creek runs some way inland, and then branches off into another creek, forming other islets: further on it expands into a lake. Other islands and other creeks follow in succession on to the desolate city of Bassein. A little way up the creek, and right opposite the fort, is a large, populous, and thriving fishing village. A fleet of boats, partly drawn up upon the beach, in part at anchor off the shore, indicates the industry and wealth of the people. A high sand-bank divides the creek from the houses of the fishermen, and here is seen in abundance the iron dust used in Bombay for sanding damp MSS. The spare spars, nets, and fishing tackle, are deposited on a framing raised on posts over a large expanse, about six feet above the ground—a sort of roof is thrown over them, so that work may be carried on in partial shade either in the first or second floor.

Here are to be seen in abundance on the beach those curious stone anchors still employed by the fishermen of Wales and Cornwall, and which along our

coasts are almost universal. The fisherman's mooring anchor is generally of stone, from four to five feet in length, of the form represented in the adjoining drawing. The stone is four-sided and pyramidal—the apex cut off. At its base it is from six to eight inches square, and from four to six at top. Through the top is a hole, through which a cable or hawser passes. Near the base are two holes at right angles to each other: through these pieces of wood are thrust, corresponding to the prongs or flukes of the anchor. The whole weighs from 80 to 150 lbs. according to the size of the vessel, and answers very well the purposes intended. These anchors are most commonly made of limestone, and are on the whole efficient, unless in heavy gales.



Though the habitations of the living can hardly be traced at Versova, the frail monuments of the dead are still entire. From the roadstead three modest tombs on a little grassy promontory close by are to be seen: on the middle one alone is an inscription—those to the right and left only indicate that the sleeper rests not in solitude—the names of her companions are not given. The following is the inscription on the centre tomb :—

Within this tomb
The Earthly Remains of MRS. CAROLINE REBENNACK,
Wife of Captain REBENNACK, of the Engineers,
are deposited.
She was born at Stuttgardt, in Wurtemberg, 7th November, 1799,
and died at Versova, 1807.

Mildness of manner, sweetness of temper, and amiability of disposition, procured her a circle of friends as sincere as they were general, their friendship being in esteem for her many virtues, both moral and domestic: the affection she evinced for her family endeared her to a husband who is, by her removal, rendered miserable, and would be inconsolable were it not for the pious and placid resignation with which she bore her sickness and sufferings, and which leaves no doubt but she will enjoy the reward promised to those who live and [*word broken off*] truly Christians.

There seems always something singularly touching in a solitary grave—especially if it be that of woman. Here the sorrowing husband left all that was most dear to him: how few have so much as read or known the words in which he uttered his sorrow! Does European eye once in ten years rest on the modest monument erected over the wife's remains? And where sleeps he—for doubtless he has slept for years—parted afar from the idol of his affections? The dead feel no solitude, know no separation, yet to the living it seems that the sepulchres of those who where loving in their lives ought not in death to be parted,—and that it might have been some consolation to think that they should rest together, and in some quiet churchyard, near the ashes

ebb tide become irresistible. Towards twilight the Pattimar spread every inch of cloth she could command, and began to water her sails as the tide became too strong for them, determined to all appearance to spare no means of escape. At the same time she dropped her anchor unseen to the enemy, who copied her in everything save this. As night drew on the breeze died away—the Pattimar remained where she was, her pursuer drifted at the rate of eight miles an hour astern. It was low water at 10 P. M., and with a light breath of air and rising tide the chase shot ahead, and by daybreak was out of sight of her pursuer. So much for a practical application of the "Maurey system" fifty years ago. Know the winds and waves, and fear not. We reached Surat at three in the afternoon. (A notice of the town, environs and river will be found under the head of the returning voyage.) I was anxious to make a series of experiments as to how the salt and fresh water tides commingled with each other, and immediately took a boat and proceeded some seven miles down the river making all sorts of observations as we went. On my return three weeks afterwards many of these were repeated with still greater care. The details are given at the conclusion. These operations have hitherto been without results, because from a severe and long protracted sickness which overtook me on my return to Bombay, and a large extra load of work which followed almost immediately afterwards, I have never yet been able to analyse the specimens of water then collected, and which have stood bottled up ever since.

It may be mentioned generally, that some thirty years ago that distinguished naturalist Dr. John Fleming, found by a series of experiments on the river Tay in Scotland, that the ascending sea tide pushes itself forward and afterwards withdraws like a wedge under the fresh water—lifting it up and forcing it back without materially mingling with it save on shallows or along the shore. The phenomenon is what ought to have been expected on the common laws of hydrostatics, and is, I have no doubt, general. One would at the same time have liked to have known how matters actually stood in the Taptee. This was my object in prosecuting the researches just detailed,—want of time compelled me to stop short before reaching any definite conclusion.

Having spent one night at Surat, during which I sauntered, under the light of the moon—then nearly full, through the whole dull, straggling and slovenly city—the first of our possessions in Western India, and then slept on board; we started with early dawn across the Gulf, for Gogo, the principal port in this quarter of Kattiawar, and got sight of land about 2 in the afternoon disembarking about 3 o'clock.

Here I expected a conveyance to meet me from Bhownuggur, and accordingly found my friends punctual and precise as the Horse Guards' clock.

An excellent spring bullock cart covered and fitted for sleeping in, was in attendance for my own use, provided with a pair of magnificent Kattiawar oxen, with two country carts for my baggage and servants.

I had on one occasion endeavoured to confer some services on the Bombay Agent of the Thakoor of Bhownuggur, and he never seemed to think he could do enough for me. I mention this as explaining the manner in which I travelled, and kindness I received while in his dominions.

GOGO, or GOGAH.—As it is more correctly spelt, is a considerable seaport on the south-eastern extremity of the Peninsula of Kattiawar. It presents a pretty, indeed almost a striking picture from the sea, from the apparent size and regularity of some of its buildings, the beauty of the trees, and symmetry of the town wall ; the expectation awakened by these are not realized on landing. It is without any pier or harbour, but being well sheltered from the S. W. monsoon, the roadstead affording good anchorage, with a clean sloping gravel beach along shore, it is rather a favorite place of resort for Native craft. A strong well-built sea wall extends for about half a mile along shore, and there is a little creek or natural shallow or basin where vessels of light draft of water haul up, and close by which boats are built. The custom house and traveller's bungalow are the buildings nearest the shore that first arrest the eye; beyond the second of these is a large native burying ground, and still further on, a neat pretty looking dwelling-house, the residence of the Collector, Mr. Stewart, an uncovenanted assistant, generally known by the familiar name of Gogo Stewart, and universally respected for his intelligence, uprightness, kindness, and hospitality wherever he is known. Much of the ground in and around Gogo is but a few feet elevated above the sea ; it is covered with sea shells and gravel, and is obviously part of that very recent marine formation which girdles the greater part of the seaboard of India. The rock consists of a tertiary sandstone passing into very rough conglomerate and abounding with fossil bones ;—the same as those of Perim, close by.* The surface runs here and there into large angular mounds covered partially with yellow, chiefly with black, cotton soil or regur. In the cracks of some portions of this I found a singular form of plated Kunkur, pure and partially crystallised. One peculiarity difficult to be accounted for lay in this : the calcareous matter must have been deposited when the clay was dry and cracked, and could in this case only have been formed from a solution—probably it appeared in the shape of a film of moisture drawn up by capillarity, and depositing its lime in successive layers on the surface of the crack. A thin scale once formed and the mould for the casting established, subsequent depositions might go on at

* See Captain Fulljames on the Fossils of Kattiawar—and Mr. Orlebar on the Geology of Goozerat.—*Journal of Bombay Asiatic Society, Vol. I.*

position the workmen could only have worked for a few hours at a time once every fortnight. A long lapse of years would thus have been requisite for the completion of the task, which when finished would have been fruitless, the stones themselves remaining beneath the waves. Their removal could hardly have been contemplated, as the rock is the same here as that presented at highwater, and the blocks, besides the difficulty of reaching them, weigh close on twenty tons apiece. As this is in the region of terrestrial undulations, it seems more than likely that the shores of Perim have sunk down ten feet since these mysterious sculptures were executed—perhaps within the past 800 years. The fossils here are the same as those which prevail in the rocks of Upper Sinde, throughout a large part of Kattiawar, and so across the Gulf along the line of the Nerbudda—far into Central India. They are the same as those in such profusion in the Sewalik Hills, and lower Himalayas, so extending to Ava and along the banks of the Irrawaddy. They present fragments of extinct varieties of elephant, rhinoceros, hippopotamus, horse, ox and antelope, with several forms of crocodile, fresh water tortoises, and fishes of the most gigantic dimensions. There are two classes of Titanic ruminants which seem to have no living types; they have been termed the Bramatherium and Sivatherium—the beasts of Bramah and Siva. About two-thirds of the island are covered with drift sand, the rest is a light brownish cultivable soil. On the western side there are some low cliffs rising from the sea shore, consisting of conglomerates and indurated clays, the same as the rock around covered with loose gravel and sand. There are five or six wells on the island, but what surprised me most of all was, the appearance of a group of large pools of water from fifty to seventy yards in diameter, and in the beginning of March from three to six feet in depth. They were devoid of vegetation even at the borders, the water perfectly pellucid, and apparently pure. The surface of the pools seemed somewhat under that of the sea, but I had no means of ascertaining the fact by measurement. The evaporation here cannot be less throughout the fair season than a quarter of an inch daily. Within the five months elapsing since the last shower fell, the surface of the lakes must have been lowered four feet at least by this means alone. The sand is too loose to indicate the line of shore at their highest, but when full they must be five or six times as extensive as they were at the time when I saw them. A portion of the island has at one time been surrounded by a strong wall, and there are still numerous fragments of buildings traceable upon it, and sculptures of no mean merit, considering the intractable nature of the material, may occasionally be met in with. Tradition universally ascribes these works to a powerful Rajput chief named Mackra Goil, ancestor of the present Thackoor of Bhownuggur.*

* Mr. Lumsden, Bombay Journal *ut supra*.

From him seem to have been descended many of the principal Kattiawar chiefs. He retired to Perim about the end of the 13th century, and was afterwards slain in battle by troops from Delhi. Perim was at one time believed to promise a suitable sanatarium for those requiring sea-air, and some troops were accordingly about twenty years since quartered on it, when it turned out so unhealthy as to compel its own scanty population to leave it as the hot season approaches, and to absent themselves till the opening of the cold weather. They consist of some twelve families in all, who occupy themselves partly as cultivators, in part as fishermen. They look sickly and seem miserably poor.

The Island of Perim belongs to Kusbatees of Gogo, named Mosumbhaee and Zacoobjee, to whose forefathers it was granted in free gift by the King of Delhi, under whose seal they enjoy it to the present day free of rent.*

In 1838, a light was erected on a sandy eminence some fifty feet above high water. It consists of a round stone tower thirty feet high, with a tall mast with a lantern on the top about sixty feet more. It is found of much use to mariners; it is abandoned from May till October—the island then being uninhabitable. It is in the bungalow adjoining that travellers find quarters, much more neat and cleanly than, and with civilities from the lighthouse people not often met with, at places of much greater pretension. Perim measured both ways from the lighthouse is four miles from the nearest point of the Kattiawar shore, and about eleven from the promontory north of the mouth of the Nerbudda. The channels in both cases considering their width are singularly deep, varying from thirty to sixty fathoms, the greatest depth being close to the island, which in some places seems almost precipitous. The tide rushes past with great violence, and its sound heard from the lighthouse is like that of a distant cataract. The stream is here confined to a channel about one-fourth the section of that which it occupies some thirty miles lower down. From this northward the bay expands and shoals towards the mouth of the Mhye and Subburmutti, and these peculiarities give us the Bore. The wave generally commences as the springs begin to lift, increasing daily in height as the tides gain in strength—reaching its maximum about two days after full and change. It is greatest with the new moon at Peragee, and during the day or night according to the season of the year. The night tides being higher by six feet than the day in winter, and converse ways in summer. Neap tides have a sweep of about eighteen feet, ordinary springs about twenty-five, and extreme springs about thirty :—When the Bore rushes up at the rate of seven

* Government Records, No. V. 1856. Collectorate of Ahmedabad.

the manufacture of all descriptions of counterfeit coin. This, from the great improvement of our coinage, and it is hoped also amendment in the morals of the people, has long since ceased.

The Chiefs belong to one of the oldest Hindoo families in India after that of Oodeypore. They were formerly tributaries to the Guicowar, to whom they paid Rs. 75,000 annually : this was in 1807, with consent of all parties, transferred to the British Government. This transfer conferred no authority to interfere with the affairs of the old hereditary dominions. In 1816 the Thakoor kept up a force of 900 infantry and 1000 horse ; these were maintained in a state of high efficiency, when they were, in 1820, greatly reduced. About this time a portion of his villages were sequestrated by the British Government, on the plea that he had hanged some plunderers who had not only stolen his cattle but slaughtered them-- this last being sacrilege in a Hindoo state. This discussion has been maintained up to the present time: in 1853 the home authorities decided in his favour, but no redress has been received by him from those on the spot.

The rock around is a hard splintry trap, the soil scanty and arid, vegetation poor. About the middle of the town is a fine pool of fresh water nearly circular, and at the time I saw it about 200 yards in diameter.

We had received an intimation immediately on our arrival that we should be visited by the Thakoor's people next morning. A little after daybreak supplies of milk, bread and butter were received, and a short while afterwards two well-dressed and eminently intelligent looking gentlemen from the palace arrived, expressing a hope that we would make a stay of some dura tion and enjoy his Highness's hospitalities.

About 9, when we were closing our observations and winding up our arrangements, having breakfasted before, a party from the palace made their appearance. Two of them had visited us in the morning, a Hindoo and a Parsee,—the latter the philosopher apparently of the place. They were all fine intelligent looking, clear complexioned, handsome men : thoroughly well-bred fo any country, with the oriental politeness and urbanity which western nations cannot match. They were utterly devoid of that subserviency so unpleasant to a stranger, as much so of the offensive condescension which might not have been unnatural in the members of one of the oldest governments on this side of India, towards a wayfarer of no wealth or pretensions not belonging to the services, and connected with a profession not certainly entitled, from the fashion in which it is pursued in India, to any very high degree of respect from any quarter.

The turn-out was a curious one : the deputation consisted of the gentlemen just described : they brought the Thakoor's carriage, a very smart Long Acre

barouche, with a pair of beautiful Arabs in English harness, and the most picturesque of whips—a Bombay Parsee, on the box. The vehicle was at once overloaded for the execrable roads, which, even through the capital, resembled those which existed "before General Wade." We had horsemen and footmen, swordsmen and spearmen—fine powerful warlike fellows, but a good deal out of harmony with the carriage. The Bazaar was neat and clean, the shops quite as good as those within the best part of the Company's dominions which I have seen,—which certainly is saying very little either for my experience or the character of the shops. The people seemed healthy and well-conducted, and the absence of those precautions we observed everywhere else beyond the limits of the British rule, spoke favorably of the morals and the police of Bhownuggur. As we proceeded, I found that the wonder of wonders in the town was an English steeple clock, erected some thirty years ago, and kept in order by the Parsee philosopher to whom I have just referred. Never having been anywhere where steeple clocks were strange, I am afraid I did not express the wonder or admiration that seemed expected of me. It was want of thought on my part: the homage looked for by my Bhownuggur friends was perfectly reasonable on theirs. I doubt if there be another steeple clock in any town in India where there is no British resident, and where all the arrangements are purely and entirely Native. The front of the palace is new : it is built of the beautiful cream-colored Porebunder stone of which the Town Hall and other notable buildings of Bombay are constructed—a stone similar in tint and texture to that of the Bath oolite. The style of the architecture deserves mention. When fancying you are going to pass through a large arch into a spacious courtyard, you find yourself suddenly jerked into a narrow, steep, corkscrew stair on one side of the portico just as you enter, and where you have to guide your steps by a handrope. This, I believe, is a common arrangement—type of Native insecurity—while the entrance way leads to nothing in particular: that which conducts you to the great residence of the ruler is so arranged as to be defended by a single sentry.

Emerging from darkness at the top of the stair, we entered what seemed a large business room—the Revenue department as I understood,—filled with writers neatly dressed, busily occupied, and very like their work, and so we passed through other rooms or offices not at all got up for show most obviously, but in good working order and with every appearance of aptitude for work.

At length we reached the presence of the Thakoor, and were presented to a rather small-sized darkish man, stately but thoroughly polite. The Durbar room was about 40 feet by 20, lined with dark panelling, and covered with mirrors and pictures,—neither certainly possessed of any great claims to

merit. The mirrors were those small wretched gilt framed things, about one foot by two, found in our pawnbrokers' shops at home and native houses at Bombay. The pictures were mostly Chinese copies of the wretched English colored prints of the last century,—George the III, Queen Charlotte, the landing of William, Buonaparte crossing the Alps, or fancy pieces supposed to represent the Great Mogul, with some twenty or thirty of the ancestors of the Thakoor. From behind a screen, as if scarcely fit company for such a gallaxy, were bought prints of Mountstuart Elphinstone and General Barr, obviously deemed the greatest men of modern times. The wonder out of doors had been the steeple clock,—the wonder in the palace was a musical timepiece, presented by the French Government to the Peishwa, subsequently given to the Thakoor. The English mail had reached Bombay just as I left, bringing tidings of the tremendous battle of Balaklava, and as conversation slackened I thought this would be news, and noticed it: the fact of the arrival of the mail was important - the battle of no account, and I was inmediately asked the price of cotton. Flowers and rosewater having gone the customary round, I was informed that a gift was intended me, and asked aside what I should prefer. My reply was, that I made it a rule never to accept a gift beyond a flower or tray of fruit: I was unable to return them adoquately, and wished no more than a token of regard, of sufficient value as indicating friendship without requiring to be of price. This answer I was told would offend: so amongst a multitude of things enumerated I namod a ring, and immediately had a beautiful emerald put on my finger. I asked permission to send a microscope in return,—a very poor exchange certainly—and did so on reaching Bombay by a friend who shewed how to use it. The Parsee philosopher was obviously skilful enough to keep it in order. Two singing girls then made their appearance, and gave us a wild plaintive air of which I could only make out the ever-returning phrase—"for I am a poor stranger."

The interview lasted about an hour, and we retired as we came. I had heard well of the Thakoor and his ministers before; as I went on I everywhere found the government praised in the highest terms, and the Carbary himself spoken of as one of the ablest, most upright, and far-seeing men on this side of India. The Court itself had long been simple in its customs and correct and moral in its character, and all these were fully borne out by whatever I could observe. Yet amidst a vast quantity of natural shrewdness and ability it did seem strange that a party of enlightened men, with free revenues of some £80,000 a-year, should have been for half a century on terms of cordial intercourse with the English, and remained in the singularly primitive state in which I found them. The treatment they have of late re-

ceived at our hands has not been such as to make them much in love with us, and like "the country mouse," they prefer their present state of untrammelled simplicity to our more perfect system of systematic supervision and dependance.

*Jan.* 5.—We started for Wullee about 11, attended by a couple of horsemen whom the Thakoor said we should find convenient as guides, and in truth very smart serviceable men we found them. The tide flows up the river about ten miles, and light vessels make their way occasionally to near Wullee. The country round Bhownuggur is rocky and sterile : by and by the rock disappears, and the land seems but little, in some cases scarcely at all, above high water ; it appears occasionally to have been covered by very high tides, and is for the most part salt : further on matters improve and cultivation makes its appearance.

We passed several water-courses from 15 to 50 yards across, obviously the channels of considerable streams during the rains. They were even now occupied by very respectable streamlets of the purest and most beautiful water. These occasionally changed themselves for 100 yards or more into very picturesque pools occupying the entire nulla. It was here we first met specimens of the pelican and of the noble and magnificent blue cranes of Goozerat. The Sarhus, or Cyrus as it is commonly pronounced, is a superb looking creature from four to six feet high, the body is pale, the wings darkish blue, the sides of the head and the gullet and upper portion of the neck bright red. They are always to be seen in pairs stalking majestically by the side of a river, marsh or pool, or sailing low in the air—the male somewhat ahead of the female—with their great flagging wings beating time. They have a sort of whistle or call when flying, that of the one being somewhat higher than the other. They are not at all shy, and suffer themselves to be approached quite close as if dreading no harm. They are considered models of domestic affection : if the one is killed or dies the other pines away alone, refusing to be comforted, and speedily following its mate. Along with these there was generally a white and often a blue crane about the size of the common heron of Europe, and both intensely pure and beautiful in tint. A group of them by the river side formed as picturesque a spectacle as well could be. I am not certain that I am correct in assuming a bird with a long beak, large body, and short legs, as a pelican ; it looked like one, but I could not get near enough to ascertain the fact.

I stopped for a couple of hours at the large village of Napoora.*—Here the villagers flocked round us and examined the instruments I had set out for

* Barometer here at 3.30—30.09; Thermometer 78°. At Bhownuggur 9.30 A. M., same day 30.041.

use; they were delighted and astonished at seeing me set fire to some gunpowder with a pocket magnifier, and from the deep interest taken here, as at most of the other places at which we stopped in all such matters as these, it seemed to me a hint might be taken by our educationists in endeavouring to open the mind through the eye, and awaken a thirst for knowledge by exhibition and experiment. A school inspector travelling with a collection of the simplest forms of apparatus with a few pictures and models, the use of which should be explained by him as he went, might convert each village schoolmaster into an instructor in physics, and while the young were taught such elementary knowledge as their circumstances and position admitted, curiosity and interest might be excited in the minds of all, the spirit of enquiry be awakened in some, and not a little knowledge imparted to others, by appliances now universally resorted to in Europe, but as yet almost wholly ignored in India, where they might be made so infinitely more serviceable. A poor man lay in the corner of the rest-house under a severe paroxysm of fever when we arrived: this left him almost immediately afterwards when I gave him quinine, and left several doses to be taken afterwards. The poor fellow seemed very grateful, and I hope a simple harmless prescription would do him good. The natives are familiar with a large number of febrifuges, and take gladly anything very bitter in taste. I question if quinine had been met with before in these parts.

In walking through the village I observed a group of three or four men who stopped me respectfully, and took me to a handsome well-dressed good-looking woman, perhaps about twenty, the wife as I understood of one of them. They said something about her eyes, and I supposed they wished me to shew the telescope or magnifier with which the others had been amusing themselves. It speedily appeared that the poor thing was blind from gutta-serna: there was no sign of this in the external aspect of her eyes, but they obviously were sightless, and the expression of her countenance was that of quiet resigned melancholy, so often observable in the faces of those suffering from this terrible affliction. The people around her seemed to be of her own family: their conduct towards their suffering kinswoman was that of affection and respect. From seeing me give medicine to the fever patient, they took me for a doctor. I sincerely wished I had been so for their sakes, but could only shake my head and express my sympathy with their afflictions. The mother of a young family struck blind has always seemed to me one of the saddest and most mournful of spectacles.

"Knowledge by one entrance clean shut out"

of all that great domestic circle, how great and excellent to its centre, however circumscribed to the outside world it may appear.

The latter portion of this day's march was accomplished on foot or on horseback, the Thakoor's sowars lending us their steeds. The last eight miles of the journey, twenty-two in all, was performed in the dark. We passed between the conical hills which had formed the most prominent points in the distance throughout the afternoon, in dim twilight, and I was not enabled to ascertain the formation to which they belonged. I have given a drawing of them as seen from Wullee, taken with peculiar care, the relation of the base to the height being verified by the theodolite. The reasons for these precautions will presently appear. Along with my own sketch will be found one from Dr. Nicholson—the two being nearly as unlike as possible. We reached Wullee about nine o'clock, and after some difficulty made our way to the caravanserai,—in this case not a mere rest-house or travellers' bungalow, but a strong-walled enclosure to which all wayfarers of all descriptions resort. But before describing Wullee, I must give some account of the Geological features of the country around, the extraordinary peculiarities of which formed my principal motive for pursuing the present route.

Recent Undulations of the Surface of Goozerat and Sinde.—Until Sir C. Lyell collected, some thirty years ago, that wonderful congeries of facts which, until then, lay so scattered as to present no mass sufficiently solid for generalization, it had been supposed that, though the crust of the earth exhibited abundant signs of frequent upheavals and depressions, that those marvels had occurred at a date so remote that the powers and energies which occasioned them had long gone to sleep, and that from the commencement of the historical period the outer world had been in a state of comparative tranquillity and repose. The publication of "The Principles of Geology" at once shewed, that all the phenomena now observable on the face of the earth could be explained on laws now in force and operating over vast expanses of time, and somewhat more energetically than at present, and that operations now in progress required only to be long enough sustained, to give us explanations of results we were in the habit of ascribing to agencies no longer existing. Even after this the impression still remained strong and general, that it was only in volcanic countries that vibratory movements were frequently to be looked for, and that the crust of the earth was likely only to undulate or become broken up where there were vents of flame and smoke in the neighbourhood.

Of the soundness of Lyell's views and the fallaciousness of popular opinion, some parts of India—and especially Cutch and Goozerat—afforded conspicuous illustrations. Somewhere betwixt the year 1757 and 1772, coincidently probably either with the eruption of Pondicherry of the first, or the Chittagong

REMARKABLE CONICAL HILLS.

*Said to be of granite, as seen from Wallee about six miles off. They are upon a low level, somewhat sandy plain, a fine stream of water beyond the tree.*

No trace of sculpture, or of anything entitled to the name of architecture even in its widest acceptation, was discoverable anywhere. There was not the slightest sign of submergence or change of level: no trace of marine or aqueous remains. The relics told their own tale: the far-famed Balabhipura —if the mass of ruins near Wullee be supposed to represent it—might have been larger in size and more wealthy and populous than the wretched little hole built from its debris; but it could scarcely have been of greater elegance or architectural pretensions—of less it hardly could have been. When it became deserted and fell into decay,—why, it is vain to enquire, when it is remembered how many decayed cities have been lost sight of

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soil, are impregnated with salt, which in some parts covers the surface of the earth with an efflorescence like that of a strong hoar-frost. These streams all run to the eastward, to empty themselves into the gulf of Cambay; but, long ere reaching it, most of them are lost in the soft sandy soil in the vicinity of that arm of the sea.

"The jungle of pilu is of great extent, and the road runs through it for upwards of a mile, at a rough computation. This jungle now occupies the site of what was once a very large city. The surface is in some places strewn with the debris of red burnt bricks, that bear all the marks of having been composed of clay mixed with straw or grass, like the Hebrew task-made bricks of ancient Egypt, though the latter were only sun-dried."

"For nearly two years (for so long only have they been acquainted with the existence of these brick *mines*) have a considerable number of men been collecting and selling these bricks for building in the neighbouring villages and towns—some being shipped on the Karri, a branch from the gulf of Cambay, are carried to Bhownuggur, the capital of the country. As far as my examination went, the soil was unmixed with fossils, or even with the debris of the ruins it had buried.

"The broken bricks seen on the road must have formed part of some building of height which had not been submerged, and which the corroding hand of time had subsequently levelled, if it had not been done by the natives of Wallay to assist in building their town.

"I observed in the excavations, several floors of houses, paved with large yellow bricks, which remained on their primitive level, attesting that at least they had not been overthrown by any great convulsion of nature, though such an occurence may have been the actual cause of their ruin; of which we have an example in the village of Sindri near the mouth of the Indus, which, after the great earthquake of 1819 (of which we have never yet had a satisfactory account, * and if there was no deeply hidden connection between the two, still it is curious to know that an earthquake took place at the same time in Mexico, and I believe also in Sumatra,) sunk down to a depth of twelve or fifteen feet, and was immediately submerged in a lake that now occupies its site, in the midst of which, not many years ago, parts of the walls were visible. If, in after-times, a rising of the ground about Sindri should occur, or if the water of the lake should find an outlet, we should be furnished with a perfect resemblance in condition to the city we are treating of."

"The walls of the town of Wallay are in a great measure built of cyclopean blocks of granite, which, it is said, were removed from an ancient road or pier leading from Balabhipura to the karri or port. The thakur stated, that the karri

* I know scarcely any earthquake, the particulars of which have been so minutely and so often given by Captain McMurdo, Colonel Grant, Sir A. Burnes, and Sir G. Lyell.

without our knowing anything as to the cause of their fall, long since Balabhipoora ceased to be—as building after building fell, the resulting inequalities became a trap for the drifting desert, and this again furnished soil for the mysterious trees found in abundance in much greater size all along the confines of the Runn, with which Dr. Nicholson was so greatly surprised. Were a similar fate to befal Bombay, twenty or thirty feet would be found to intervene betwixt the surface of the raised mound and the foundations of former structures, two or three times as much as intervenes betwixt the present surface and the lowest foundations of the remains of the ancient Balabhipura, and these in ten years time would be rounded over with dust and shaded with jungle.

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anciently was much nearer the city of Balabhipura than it is at present to its ruins, when a great trade was carried on here. This would tend to show that the gulf of Cambay is gradually being curtailed of its limits, a circumstance that accords with the views I had adopted after examining the breccia stratas of the Island of Perim, situated in that gulf, the result of which was communicated to, and published by, the Bombay Branch of the Royal Asiatic Society, in 1840, in their Transactions.

"The fact that the gulf is diminishing is also, I think, evinced by the extensive and evidently sea-deserted tracts of downs at Domus, near the mouth of the river Tapi or Tapti.

"On making inquiries of the thakur concerning the globular granite stone in the centre of the circular temple, he stated that there is a legend in his family, that some one of his ancestors, in the hope of finding treasure, had attempted to dig up the stone; but after a hard day's labour, on repairing to work in the morning, it was found that the stone had, during the night, sunk just as deep in the soil as it was before operations had been commenced against it. After several futile attempts, the peculiar deity or *genius loci* appeared to the covetous sinner during the night, and forbade him to pursue his useless and sacrilegious attempts; and, in consequence, the natives implicitly believe that no mortal efforts can remove this stone.

"There is also a legend concerning the destruction of the city, to the following effect:—'This country in ancient times was inhabited by a race of people quite distinct from the present natives, when a mendicant Brahman arrived at the gates, demanding food and lodging, which having been rudely denied to the holy man, he took a cup of water (though where he procured it this legend saith not,) dashed it against the walls, and at the same time uttering certain maledictions, he shook the dust from his feet and departed;'—shortly afterwards the whole city, together with its inhabitants, were swallowed up by an earthquake, or some other destructive convulsion of nature.*

"I now proceeded to Chumarwara in order to examine the quarries whence it is stated that Balabhipura had drawn her supplies. The heat was excessive, and I despatched a native to look for and to apprise me of the position of the quarries in the hills, whilst I rested at the foot; but on his return he reported that he had not found any such places. These singular-looking peaks, resembling islands rising out of the water, consist of a light-coloured granite. The lower part of the chief one, on which some portion of the village of Chumarwara is

* The legend is clearly a counterpart of that given by Burnes, as explaining the cause of the drying up of the Runn of Cutch.

I never remember to have been engaged in any enquiry where I felt such perfect confidence in the conclusions arrived at, these being in the most entire opposition to the assumptions with which I had started. The assumptions themselves being in perfect consonance with probability, only they were upset by a clear and uniformly developed series of facts,—there remaining not the slightest trace of a presumption on the opposite side saving this one only,—that Cutch and Kattiawar having, within the past eight or ten centuries, been subjected to many alterations of level, the submergence in relation of Wullee, had it been depressed and elevated, might have been one of them: only there was no evidence of the fact, and many very strong presumptions, from the appearances around, against it.

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built, on the north-east side consists of immense granite boulders, all more or less rounded off at the ends and sides into spheroids or oblong rollers, like rocks that have been long exposed to the action of water. Several smaller hills, all very rugged, and bearing in some places the columnar structure, are studded at some little distances around the principal hill; but the visible parts of these smaller ones are perfectly unconnected with the chief one, and the ground between them, from one hill to another, is as level as the surface of water; and that it has been thus formed by water there can exist no reasonable doubt, for from this point eastward the Runn or water-deserted desert extends to the gulf of Cambay, now several miles distant I had no means of ascertaining the height of these peaks, but should not think. that the highest exceeded one hundred feet; though on this point I may have been much mistaken, and the mirage, which was in full force at the time, would not assist me in my conjecture.

"If there are really no quarries to be found on the exposed parts of these peaks, (but I do not put much dependance on the natives' assertions), it would lead us to infer that the catastrophe had been the result of a subsidence of the group of hills together with the adjacent country; water (most likely of the sea) had then filled up the space, and been the cause of all the appearances already described. But in this case how is the water to be got rid of, unless we take it for granted that there had been a subsequent subsidence of the gulf of Cambay? That this has in reality either been the case, or that the bed of this gulf must at one time have been upheaved the existence of the Island of Perim attests. For a moment assuming the latter theory to be correct, we can easily imagine that the bed of a large sea being suddenly elevated, the water would overflow the neighbouring country, which was nearly on a level with its surface before the commotion took place. The water would then remain over its new acquisition till time and the action of the water had deepened its obstructed bed. And this theory derives some support from the fact that several of the strata composing the Island of Perim have been washed away from around it, which at one time must have formed the bottom of the gulf, and the remains of these strata, forming the island, are high above the water, as can be ascertained at once by a look at the section of that island."—*Journal of the Royal Asiatic Society*, 1851, p. 153.

The drawings of the Churnarwarra Hills furnish instances of Dr. Nicholson's inexactness. As explained in the text, I have not the means of examining the hilly islands and blocks in and around Wullee, assumed to have been obtained from them, they have the forms of slightly columnar pleutonic or volcanic rock with nothing whatever to shew, whether it has been by the water or the weather that they have been abraded. Nobody doubts that the land all around has risen and descended: what we want to know is, when? There is no evidence whatever that the Gulf of Cambay is filling up. The *re-*

The Thakoor and his followers, as already said, accompanied us all over the ruins for a distance of three miles, and though two hours investigation was certainly not at all sufficient for such a field of enquiry, the facts were all so consistent and uniform, and so utterly subversive of the theory—the truth of which was meant to be enquired into, that I know not that much more could have been learnt had we expended weeks or months in place of hours in our researches. Our friends were wonderfully struck, as usual, with the disclosures of the pocket Magnifier, especially with its application as a burning glass to fire a matchlock. The mysteries of the Barometer were beyond them—the Thermometer they partially understood. The Compass and

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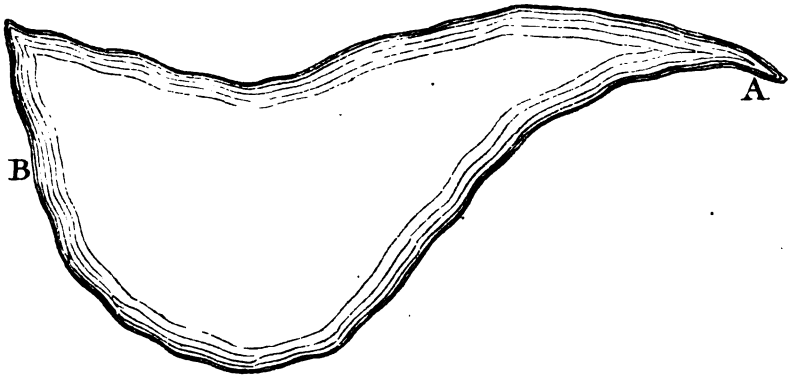
*cent* movements seem to have no apparent connection with the stratification, either at Perim, or Domus, of much earlier date. Dr. Nicholson's paper was, as he informed me, in reality prepared for the Bombay Society somewhere about 1846, at a time when the doctrines of frequent change of level at a comparatively recent geological date, were only beginning to find acceptance. It somehow unfortunately was never printed in our Bombay Transactions, by the time that it did appear, many new facts had become known and doctrines were broached not then before the world, and of which the writer, had they been within his reach, would in all likelihood have availed himself:—

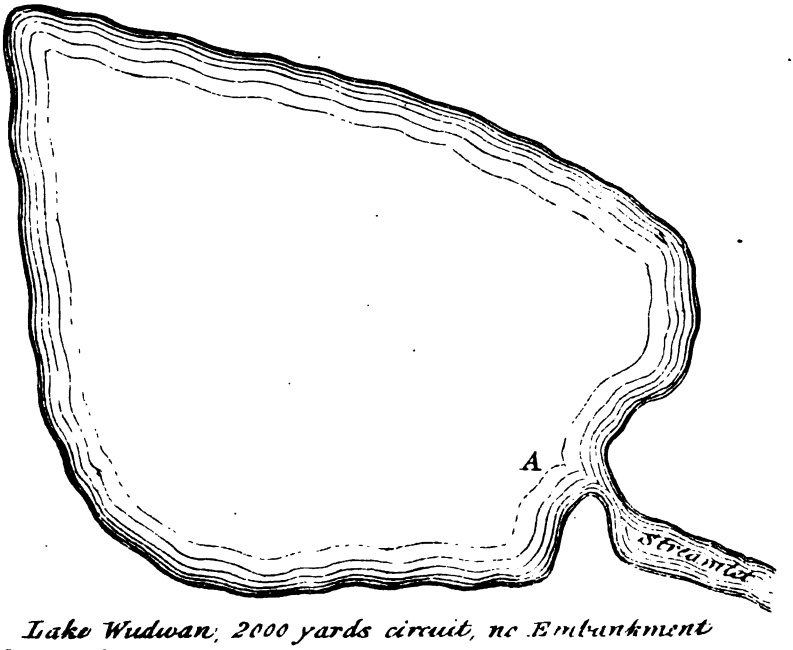
"The extreme antiquity of these ruins I think is proved, perhaps not so much from the depth of the superincumbent soil which has overwhelmed them (for this might be the work of a very short period of time) as from the enormous size of the very slow growing *Salvadora Persica* flourishing upon it; from the art of making such excellent bricks of a mixture of straw and clay (for on breaking a fragment of one of them, a great many tubular cavities are seen, running in all directions through its substance); and from the use of these bricks to pave the floors in their houses, so totally at variance with the knowledge and customs of the present race of Hindus, whose habits we have been accustomed to consider as less changeable than the laws of the Medes and Persians. These points indicate the antiquity of the ruins more than the cyclopean dimensions and the fine workmanship of the granite monuments, for we can with accuracy, I believe, date the time when similar works of art were produced in other parts of India.

"When the bricks are first dug out of the soil, they are saturated with moisture, and are softish, but on being exposed to the sun, resume their pristine hardness. The yellow bricks appear to be softer than the red ones, and it is probable the former had been burnt in straw, whilst the latter had been baked in cow-dung or wood fires."—*Ibid.* p. 152.

The Bricks so far from being excellent, are execrable:—I say so as a brick-maker. They are 14×7 inches or $8 \times 1\frac{1}{2} = 2$ and $2\frac{1}{2}$, about the size and form of those presently manufactured at Surat. The clay has been slightly wetted and fashioned upon the rough irregular ground into bricks, when it was formed without any attempt at mixing or tempering. The brick boxes themselves must have been very irregular in their forms. The upper surface has been overwet and badly smoothed—the lower one is rough and irregular to the last degree and full of cracks. In place of there being any proof of the bricks having been burnt in kilns or by different kinds of fuel, the likelihood is, that they were dealt with after the Surat or Kurrachee fashion—built up in long trenches and mixed with dung dead carcases, bones, wood, or anything combustible that presented itself: the difference of aspect depending on the part of the kiln from which they were drawn.




*Tank Hagella, Kattiwar, 1200 yards circuit. A, Marsh Weeds; B, Embankment 10 feet high, 120 across, and 1000 long.*




*Lake Wudwan; 2000 yards circuit, no Embankment A, Streamlet.*

nature. There are commonly fine clumps of trees around the lake or near the village, many of them aged in appearance but of no great size.

The rationale of this, to me most surprising state of things, is by no means difficult. The evaporation over these districts, judging by that at Bombay, Kurrachee, Aden, and other parts where the fact has been carefully determined, amounts for the year probably to 80 inches, and does not intermit even during the rainy season, excepting in periods of actual fall, the rain being in all less than one-third of this. The fall seems so gentle while it lasts as to cover the country with a general suffusion of moisture, which sinks rapidly into the soil and accumulates in hollows without occasioning torrents or maintaining rivers; it leisurely finds its way to the lower levels, and in part ultimately to the sea, filling the hollows which it passes and maintaining them full. So soon as the soil gets dry to the depth of a few inches, from the bad conducting power of the earth, evaporation and capillary action cease, and the moisture underneath continues to pervade the lower strata till drawn off by the roots of plants, tapped by wells, or attracted by

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S. W. W., and as far as N. W.; and during the whole time there was thunder and lightning, but of no great severity. As might be expected, this heavy rain has occasioned considerable loss of property, the mud huts of this district being little capable of withstanding so severe a storm. The bridge connecting the camp and town has been partly washed away, and one of the round bastions of the town wall has fallen;—but I have not heard of any loss of human life or severe accidents, though the bed of the river on its subsiding was studded with the bodies of drowned cattle. Many trees have been blown down in camp, where they could ill be spared, and many outhouses have fallen in. The cavalry lines have suffered most severely, nearly half of the huts having fallen, this part of camp in appearance much resembling some of the sketches of Irish desolation which have lately appeared in the *Illustrated London News*.

As a means of comparison, the total fall of rain at Rajkote during the monsoon of 1850, that of

| | | | |
|---|---|---|---|
| 1843 | was | 27·56 | Inches. |
| 1844 | | 22·43 | |
| 1845 | | 12·19 | |
| 1846 | | 31·15 | |
| 1847 | | 21·01 | |
| 1848 | | 24·21 | |
| 1849 | | 63·10 | |
| | | 7)201·65 | |
| Inches..... | | 23·31 | average of seven years. |

From which it will be seen, that the fall on the 27th July alone was equal to the average total fall of the whole monsoon of the preceding years. To place this heavy fall in a more striking point of view I may add, that the average total annual fall of rain is—

masses of liquid water.* The whole phenomena are meteorological, and must present themselves where rain falls leisurely and in moderate quantity, and the evaporation throughout the year is materially in excess of the fall.

The wells along our route varied from 12 to 46 feet in depth; the water was almost everywhere hotter—not only than the hottest part of the day or mean temperature of the winter season,—but than that apparently of the year. We have no data on which the slightest reliance can be placed for ascertaining what these actually are, and can only venture on a guess from the Bombay observations. These give the means for May and June at 85° for January, and February at 76°, as ascertained by hourly observation, or 80 for the whole year. As the northeastern part of Kattiawar is from three to four degrees to the northward, the mean temperature can scarcely be supposed higher than 77° or 78°, and as the range is very much greater, we shall not perhaps be materially out if we assume 68° as the winter, and 82° as the summer heat. The temperature of a very large number of wells varied from 80° to 83°—the singularity being, that it not unfrequently happened that of two wells of nearly equal depth within a few scores of yards of each other, one might be 81° or 82°—the other 76° or 78°.

I had no means of testing the Bombay springs at the same date, but the cold seasons of 1855-56 differed little from each other and were in no way remarkable. The comparison of both may be considered relevant, the result will be found at the conclusion of the paper.

I did not subject the water of the wells to any test: they tasted sweet and pleasant. Nearly the whole wells in the presidency have been analysed by

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| | | |
|---|---|---|
| At Paris | ..... | 20 inches. |
| London | ..... | 55 ,, |
| Geneva | ..... | 30 ,, |

The total fall of rain at Rajkote this year, up to the present day, has been 47½ inches.—R. K.

* The reader will find a very interesting account of the singular cold of the wells around Peshawur in the Ninth number of our Transactions, 1849-50, p. 24, by Dr. Malcolmson: the water of the wells continues uniformly at 58; Peshawur is 34 N, and 1,000 feet above the level of the sea. If we suppose the mean temperature of the year to be in both cases indicated by the wells, we still have two places only ten degrees distant from each other—meridionally differing by 22 degrees in mean temperature—something unprecedented in Climatology.

In the published extracts from the Government Records, No. xii, 1855, the temperature of Sadra is given as follows:—

| | Max. | Min. | Mean. |
|---|---|---|---|
| 1851 | 90 | 75 | 82 |
| 1852 | 91 | 72 | 81 |
| 1853 | 93 | 72 | 82 |

the black buck being amongst the most abundant and beautiful. They browse by the wayside, or sweep along the fields quite within pistol range and unconscious of danger; and I have seldom felt myself conscious of a more cowardly act than in shooting a half-grown fawn and afterwards a fine buck, who suffered where they meant no harm and dreaded none. The magnificent Sambre, or Elk, often reaches the height of 5 feet from foot to shoulder, of nearly 8 to the crest, with a spread of antler of 6 or 7; and the Nielgye, or Blue-Ox, attains dimensions still more magnificent. There are hundreds of small sized hares and rabbits, with plover, bustards, florikin, black-partridges, and quail in abundance; there are three or four kinds of pigeon, five or six varieties of duck, teal, snipes, and I will hardly trust myself to say how many other forms of game.* Of course this state of matters only obtains in districts rarely visited by Europeans; where sportsmen make their appearance wild animals of all sorts keep beyond their reach. But for the natural checks the entire crops would be eaten up by these tolerated intruders, whose members, unless thinned out, would press upon the means of supply. The checks consist in multitudes of short-maned lions, tigers, leopards, and panthers, wolves, jackals and hyenas,—the first class disposing of the fresh provisions they kill, the second being content with carrion,—vultures, kites, and all the obscene birds which fatten on putridity close up the arrangement, and produce that balance in the powers of vitality and decay the hand of man refuses to redress.

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is almost neglected, and the inhabitants depend for the means of subsistence principally upon the milk and ghee furnished by their cattle. Partly from this cause, and partly from the strictness of their religious tenets, which rigidly forbid the death of any animal, every family has accumulated a large stock of cattle, and these, amounting to hundreds or thousands according to the size of a town, are invariably driven within the walls at sunset, and are penned for the night in the same house which contains the rest of the family. Thus no limits are set to the number of cattle accumulated in every family excepting by death the consequence of disease, or old age.

"Still all animals are doomed to die; and, notwithstanding the humanity of religious tenets, this forfeit must be paid in one way or other. In proportion, therefore, as we diminish the number of deaths by artificial or violent methods, we should naturally expect an increase to the number by natural causes; or, in other words, that disease and sickness would be multiplied. Accordingly we find this to be the case, the cattle of Kattywar afford the clearest proof of it; few seem altogether free from disease, and many are seen in the most wretched condition, crippled and crawling about with swelled legs and diseased skins."

* Dr. Gibson mentions the Adjutant and Flamingo as amongst the birds of Kattiawar: no better authority need be desired, though I am not conscious of having observed any specimen of either. I saw indeed only a small portion of the wild animals I have enumerated, and give the rest on other authorities.

I seldom remember to have spent three happier days than those on which I resided in the camp at Wudwan.

FROM WUDWAN TO THE NULL.—Jan. 11. We left Wudwan a couple of hours before daybreak, proposing to have an unusually long day's journey. The first portion of the route lay nearly at right angles to that which I had hitherto pursued across the upper end of the Eastern Runn, where I was anxious to visit a singular detached brackish lake, which had to all appearance originally formed the terminal portion of the Runn when that which is now a salt marsh was an estuary.* The Thermometer on leaving Wudwan at half past 4 A. M. was 58°—a temperature which makes a Bombay native shiver and look most uncomfortable. Fires had by this time begun to blaze near all the tents around—the people sitting so close to them that they looked crumpled, much more like as if they were being cooked, trussed up, motionless as they were, than warmed.

About 10 miles from Wudwan is the village of Seahore—by much the cleanest and most thriving looking we had hitherto met with. It was situated on a considerable plateau about 20 feet above the adjoining country. It was surrounded by a tolerably good low wall, with gates and turrets, and divided by moderately open and not very filthy streets. There were four or five huge hay stacks near the centre of the town, black and fearfully perforated by rats; they were stated to have been provided for the service of the Guzerat Irregular Horse, but seemed to have stood for many years neglected. Close under the walls of the town is a beautiful little lake, pretty nearly a mile in circumference, with a handsome small-sized mosque on its margin. Here was a neatly kept, well-enclosed native burying ground, the first in those parts I had seen. The grounds around seemed fertile and were well cultivated, the people appeared industrious and comfortable, presenting a wonderful contrast to all we had hitherto seen within the peninsula of Kattiawar. The general aspect and character of the country was pretty much the same as that of the districts we had hitherto passed. The lake referred to was of exactly the same description as all the pools of no-exit hitherto described—only a little larger, and no village was to be met with anywhere without one of these being found close at hand.

We reached Bavelee, close by the Null, late in the afternoon. It is one of the most dilapidated and miserable looking places we had yet seen. There is not the less a very fine little lakelet adjoining, and this is surrounded by handsome trees, amongst which far finer specimens of Ak than those des-

* The following are the towns and villages on the route from Wudwan to the Null :—Wudwan—Marmcoo—Khugailee Seahore—Foolwady—Rosasur—Bavlee —the village of the Null,—close on 24 miles in all.

cause of the loss of time it occasioned, and second, because I was anxious to cross the Runn where it tailed out above the Null.

Having turned off at an acute angle to the track previously pursued, I shortly afterwards entered the Runn, and continued to toil through it for a distance of some seven miles, which it took three hours to accomplish. The road, if the term may be employed, is a mere cart track, which for half the year must be a nearly impassable swamp. The mud of which the surface consists was in January perfectly dry, but the wheel ruts were from 8 inches to 2 feet deep, and that the wheels did not sink to the axles altogether, was due to the roots of the reeds and gigantic grasses which form an impenetrable mass all around. We could not see the tops of the carts which followed us a hundred yards off. There was no landmark of any description to guide us: fortunately there were no cross or side roads to lead us astray. When we met with carts or camels, they required to get into the reed forest to let us pass. The air was stagnant and the heat oppressive, and the whole scene one of unspeakable desolation, and to me—and I should think to most—of the most perfect novelty. At length the grassy and reedy jungle began to become more feeble; the horizon expanded before us, and by and bye in the distance we could descry the tops of bright green tufts of trees. At length we emerged from this singular morass, and found villages of considerable beauty, in tolerable contiguity to each other, accompanied by the never absent lakelet and tufts of trees. There was still little change in the aspect of the country or soil. The roads, though just as Nature left them, were but little to be complained of, the climate being so dry, and the soil so liberally mixed with clay and sand, as to prevent the fearful ploughing up and the almost indescribable condition of things prevalent from Ahmedabad to Surat.*

JAN. 13TH. DOLKA.—Starting at dawn from one of the first large villages eastward of the Runn, we reached the ruined city of Dolka about noon—and a very noble one it must have been, complete as is the delapidation into which it has now fallen. The road takes a long sweep of nearly two miles as the town is approached, and I was under serious apprehensions we had missed our way and were going past it. At about this distance the plain is covered over with round curious looking mounds from 10 to 30 feet in elevation, as if indicative of ruins below. Water seems plentiful, and the ground is well

* The following were the villages we passed after leaving Bavlee on the Null—Puralee on the Runn—Pownalee beyond the Runn; Waijee,—20 miles in all. Here we stopped for the night, being assured that we should find no quarters for a long way ahead. The Thermometer in the course of the night fell to 43°, the lowest temperature we had yet experienced: it felt most uncomfortably cold.

cultivated. Wells of the depth of from 15 to 20 feet I found to vary in temperature from 81° to 83°,—even in the sun the mercury scarcely rose above 60° At Bombay under the same circumstances it would have been 110° at least. The first six miles of our road was flat and sandy and very barren. About 9 we stopped at a large village with a lake of considerable magnitude close by. I never remember to have experienced a cold so persistent: at sunrise it had been 43°, it was now only 45° and the thermometer fully exposed on the dry sand to the direct rays of the sun only rose to 57°, and refused to get higher even when covered for 10 or 15 minutes with a piece of black silk. The water here was 50°, but at a little distance off I observed a well being drawn upon, the water of which steamed like a cauldron for full half a mile along the channels which supplied the fields. Thither I repaired to dress: the water was only 30 feet deep at surface, the well 40 in all, and my only regret was, that it did not provide the means of bathing. Some magnificent trees close by were literally covered with long-tailed monkeys—the females in many cases rocking their young to sleep by hanging by one hand and one foot to a slender branch, and swinging for a sweep of some feet, with the other arm holding the little one to the breast. They approached so near, and watched me so narrowly with such utter absence of all alarm, that I was more than once apprehensive that I might see some of them dressed in the clothes I had just thrown off. The water fresh drawn was 85°; at this it felt disagreeably hot. As we approached Dolka I made drawings and measurements of several singular looking vehicles, all apparently quite new, of extraordinary length, and with from six to eight wheels, like those of the common carts of the country. I presumed that these were going to bring in heavy logs of timber, there being many fine trees in the neighbourhood. On enquiry it turned out that they were not vehicles at all, but that this was the customary way of taking new cart wheels to market. As many axles and pairs of wheels as could be conveniently attached together were made fast to a long pole, and so dragged along. It furnished a good lesson of accepting nothing mysterious as fact without minute enquiry.

Dolka is about 22 miles S. W. of Ahmedabad. The city with the adjoining villages contains a population of above 100,000. There are said to be no accurate records in existence regarding it: it is believed to be the oldest town of any note in Goozerat. It is about seven miles in circumference, abounding in fine wood and the remains of rich mosques, tanks and gardens.

The most remarkable thing about Dolka is a beautiful lake about 400 yards in diameter, built around with a finely cut and enriched stone wall, with flights of steps down to the water at regular intervals. In the middle are the remains

The northern capital of Goozerat, on the banks of the Saburmuttee, was formerly one of the first cities in the East. It was built about the year 1426 by the Sultan Ahmed Shah, on the site of a still more ancient town. It is said at the time of its greatest splendour to have occupied suburbs including a circuit of 27 miles : at present it is reduced to less than a fifth of this.* It was enriched by its founder by many noble mosques, tanks and other structures, the most magnificent of the former being the Jumma Musjid, or Grand Mosque, which stands near the middle of the city. The minarets of this building, together with a great number of other spires, and about three hundred houses, were thrown down during the terrible earthquake which desolated Scind and Western India in the middle of June 1819. The city everywhere abounds with relics of ancient grandeur, and few more acceptable services could be performed to Archæology, than a good collection of faithful drawings or large-sized photographs of the architectural remains of Ahmedabad.† Ahmedabad is still famous for its gold, its silks, and its carved work, and its merchants and brokers enjoy a distinguished reputation for liberality, wealth, and enlightenment. They lately (May 1856) subscribed Rs. 50,000 for the erection of an university amongst them,—an establishment for which I think it doubtful if any city in Western India will be ripe for half a century to come ; but the contribution was an evidence of their anxiety for education, mistaken as their views might be as to the best mode of attaining it.

KAIRA.—Early on Monday morning I left Ahmedabad for Kaira, formerly a military station, about 22 miles to the south east. For several miles after getting beyond the gates of Ahmedabad, are splendid fragments of ruins—mosques, mausoleums and tanks, in the midst of the most beautiful groups of trees I have ever seen. I measured several wild mango trees from 15 to 18 feet in girth. We passed one magni-

* Forbes' Oriental Sketches.

† It may tend to the advantage of future travellers to mention, that the Bungalow of Ahmedabad though a very neat and comfortable building, was, on the 13th January 1855, the filthiest human residence I had ever entered, the attendants being models of incivility. I do not know who the party was responsible for this, but the state of matters was most disgraceful—the people almost as uncivil as the premises were filthy. The mean temperature of Ahmedabad appears to be 80°, from the mean of ten years, the same as Bombay, though four degrees further north. A well 30 feet deep close by the bungalow was 80° at 9 P. M., air 68.°

At 9 P. M. Ther. 62°—Bar. 29·939. Morning maximum at Bombay following morning—sixty, and close of day at the Observatory 30·06,—the previous morning 30·010. The difference betwixt the Ahmedabad observation .065 is scarcely more than is due to that betwixt the morning and evening maximum at the presidency at this season. From the Government Observations generally I should infer, that the mean pressure considerably increased northward.

ficent tank about 700 yards in circumference. It is eight-sided, the parapet and retaining wall descending by three large steps 3½ feet perpendicular each and two feet across, from summit to water surface 14 feet. There are eight handsome double sets of steps, one on each side, descending to the water, the whole forming a very elegant piece of architecture indeed. The country here is singularly rich and beautiful, the roads most execrable; but the Natives have never known better, and did not complain: how governments that produced architecture so exquisite should have put up with thoroughfares so execrable, is not very easily explained. We had somewhat lingered on our way in the forenoon, and it was past nine o'clock before we reached our quarters, in which was formerly the officers' barracks in Kaira, and so we missed seeing the town.

Kaira is the capital of the district, now the Collectorate of that name, and is the head-quarters of the judge and magistrate. It was acquired by us from the Guicowar in 1805. It contains a population of about half a million, and yields a revenue of £200,000 a-year. The cantonments, now ruined and desolate, are about a mile south of the town. Here a considerable force used to be maintained, the European portion of which consisted in a troop of horse artillery and regiment of dragoons. The station had always been sickly, and in 1824 H. M's 4th Dragoons suffered so severely that it was abandoned, Kirkee near Poona being, from that date, the only Dragoon station in the presidency. The barracks are now mostly unroofed and hastening to ruin, and the officers' quarters, in which the traveller finds refreshment and repose, are still in good repair, and the neatness and cleanness of the apartments, and attention of the people in charge, formed a pleasing and very striking contrast to the state of matters met with the previous day at Ahmedabad.

The Barracks stand on the highest part of a fine English park-looking plateau, sloping on three sides down to the river, which here makes a nearly semicircular bend. In the middle distance, just beyond the river, peeping from a magnificent grove of trees, is one of the rarest things to be met with in India, excepting in our largest sized towns—a really handsome and tasteful Church and spire. It was, like six others, built in Mountstuart Elphinstone's time, and opened for worship in 1823. It is much the form of that of Tanna, and not unlike the Byculla Church; it cost £7,500, and would probably accommodate 800 people; it is very neatly and tastefully fitted up, and kept in tolerable order. Singularly enough both steeple and walls are painted of a deep blood-red—the corners, cornices and architraves left white; and what is still more singular, unusual as the colour is, and strange and harsh as it might have been supposed amidst the rich green of the adjoining foliage, it did not strike the eye as at all unpleasing. I only wished they had left

reached a message followed me, requesting me to go to the cutcherry of the Collector. Here we found a large native establishment at work on revenue matters, most of them fine, clean, intelligent-looking men, many of whom had grown old in the service. There was no European on the spot, but civility to strangers seemed to be a standing order. The residence of the Collector was thrown open to us at once; we found everything neat and clean, and the Revenue Commissioner himself could not have received greater attention. Quitting Neriad in the afternoon we crossed the Mahae, and entered the dominions of the Guicowar just before dark. The river here is very similar in all leading features to the Saburmuttee, where we crossed, 14 miles S. W of Ahmedabad. It is about 450 yards across, of which the water occupied some 50 yards to the depth of about a couple of feet. The rest of the channel is covered with beautiful white sand and fine gravel, both abounding in minute fragments of agate and carnelian. The banks are of dark yellowish clay, of 20 to 25 feet in height, precipitous and often overhanging their base. The water in the river, like most of that in the open pools, varied from 40° to 50° in heat at daybreak, being five or six degrees below the mean of the air; the wells when above 30 feet varied from 80° to 81°. A little after daybreak I found myself approaching the British Cantonment, Baroda, through a long avenue of trees. The thermometer at this hour was 46° with a strong dry cutting north wind, cold and comfortless. On the verge of the drill ground is a Catholic chapel and churchyard, and close by the road is a simple monument with the following inscription in English and Marhatta.

1831

ABAJEE SHAMJEE, Soobadar, 25th Regt. N. I.

THURSDAY, 18th January.—Baroda is the capital of that portion of Goozerat still subject to the dominion of the Guicowar, a Marhatta chief formerly holding under the Peishwa. I visited the town, which is about two miles from the cantonments, the day of my arrival. The Marhattas made it their boast that they lived by war and on horseback, or in tents, and paid no regard to the beauties or luxuries of architecture; and nothing certainly could contrast more strikingly with the magnificent monuments of Mahommedan taste and splendour at Dolka and Ahmedabad which had filled us with admiration, than the wretched mass of miserable structures, the narrow streets and unseemly public buildings which constitute the regal city of Baroda. The Guicowar was returning home as we reached what is termed the Palace, with elephants and horsemen, and footmen and music, and shouting the most discordant yellings, the most motely crowd that could be conceived. The band of a caravan of wild beasts

at a country fair in England was dignity and splendour, compared to the mock pomp and beggarly circumstance attendant on the crowd in the procession of one of the last of the Marhatta sovereigns. Yet Baroda is a place of vast wealth, it contains a population of above 100,000, is the seat of the administration, and has long been proverbial as a den of political corruption. The houses of the cantonments are arranged in two long parrallel lines, with a fine wide, smooth, grassy space betwixt of about 200 yards across and three quarters of a mile in length. Near the centre is a monument to the memory of the late Mr. Williams, our first Resident, unfortunately left without an inscription. The Residency is a very handsome, indeed a noble-looking building, a considerable distance to the westward, and nearly in line with the vista just described.

The place upon the whole must, I fear, be pronounced dull and uninteresting. The Resident was absent on a hunting and fishing expedition on the Mahae. where he was to be joined next morning by the Guicowar. Neither of these two varieties of amusement are pursued quite in the way that meets an Englishman's conception of sportsmanship.

At the periods of spring-tide, when the Bore prevails, a large wave rushes up the Mahae with great velocity. When it has completed its ascent, and before ebb begins, a net is shot across, when vast multitudes of fish are entrapped. What is called hunting, again, consists in surrounding a wooded space into which game of all sorts has previously been driven. The sportsmen, mounted on elephants, take up a post near the only point of exit permitted, and the terrified creatures are killed at pistol-shot distance as they endeavour to make their escape. Such are the views of the Marhatta Prince of sport, sufficiently wide certainly of those of British sportsmen, who spear the wild boar from the saddle, and beard on foot the tiger and lion in their lairs.

We had once more begun to see clouds in the sky, and to enjoy those lovely vapour landscapes overhead, the want of which was felt previously to be absolutely painful. Hills now also came in view, Powanghur being conspicuous. This noble eminence is 1800 feet in elevation, and looks from its isolation much more. It has been strongly recommended for a convalescent station, and is a favourite hot-weather resort for the residents at Baroda. With a temperature from 15 to 20 degrees lower than that of the plains. From March till October strong, often violent, winds prevail from the S. W. from dark till daybreak, when perfect calm exists not only in the low country but half way down the hill. The phenomenon is singular and not very easily explained : there seems no reason to doubt of the fact

stated to me by an officer of much intelligence, and who had long resided on the hill.

The Brigade Major, Capt. Crawford, had for some time been anxious to obtain a much more copious and trustworthy set of meteorological observations at Baroda than had heretofore been taken. I carried with me accordingly a set of instruments for his use. The barometer meant for him, a very fine instrument indeed, had unfortunately got its tube broken in the tremendous joltings of the Goozerat roads. It had before this got injured on its way from home, and I had just put a new tube in it, and not taken, I fear, sufficient care to pad it with cork. On lying slightly inclined in the bullock cart, the glass snapped with the load of the mercury. I left behind, however, the instrument I had taken with me for my own use, and have no doubt that under supervision so able and energetic the results will be found valuable.

Baroda is the only place in Goozerat where good arched bridges are to be met with, and the apparent lightness of one of these, called Waddington's Bridge, from the distinguished engineer by whom it was built – (now General Waddington, head of our Public Works' Department) made it be looked on by the people with suspicion. The Guicowar could never be persuaded to trust himself across it on an elephant.

Baroda to Broach.—I quitted Baroda at daybreak on the 19th, and walking through a portion of the town passed the Mootee Bagh, a garden house of the Guicowar, just as his Highness was preparing to join the Resident for a grand hunting party on the Mahae, and was thus furnished with an opportunity of witnessing the nature of the turn-out customary on such occasions. Six elephants richly caparisoned and almost covered with scarlet cloth, stood near the gate, with not fewer, I should think, than 500 horsemen very picturesquely equipped, but with as small regard to uniformity as could be imagined in a body of military. The only thing common to them all was the native crooked sword, or tulwar. Nearly all had firelocks of some kind or other:—Long native matchlocks of every form, muskets, English rifles and fowling-pieces, single and double barreled, flint or percussion, as the case might be. Though of a vast diversity of ages, they were nearly all muscular, strong, active looking men, probably not unformidable in the field if properly led. His Highness himself is a diminutive, undignified dark-colored man, who certainly impresses the beholder much more with the idea of his sensuality—especially his addiction to opiates and strong drinks, than as endowed with any great amount of talent.

The wells a little south of Baroda measure from 40 to 60 feet in depth; the temperature at the surface of them on being carefully drawn up was mostly

about 70° —a little way down it rose to 80° and so continued to the bottom. I here met in with a fine specimen of that clumsiest of trees, the *Adansonia Digitata*: it measured 38 feet in girth, with various beautiful Tamarinds from 8 to 12 feet, the latter being, so far as I know, an unusual size for this variety of tree. About ten miles to the south of Baroda I met in with the first genuine specimen of the true black Cotton soil I had observed; a more particular account of it will be found at the end of this paper. The soil of Kattiawar consisted of a light rich sandy loam—those from the Runn eastward and south of a tenacious yellow clay. Some seven or eight miles south of Baroda are the remains of what appears to have been a large massy bridge of brickwork —the foundations of the arches and two entrances alone remaining. This I presume to be that described in Forbes' Oriental Sketches, as crossing the river Biswamertree. The engraving he gives of it represents it as consisting of two tiers of arches, one below the other, the lower tier consisting of five, the upper one of eight, the parapet being pierced at regular intervals with arches of lesser size. The structure as represented is a handsome one, and the writer speaks of it as the only arched bridge he had ever heard of in India. But for the drawing it would now be impossible to discover what it had ever been.

As we had performed a journey of considerable length in the morning, and had still a long stage before us, a good part of which required to be gone over in the dark, I ordered the bullocks an extra feed, which I fear proved fatal to one of them. When within a few miles of our journey's end, at the village of Tankaria, he seemed uneasy and out of wind. He was unyoked, and in a few minutes dropped down and died. The night was very dark and the road indistinct, but we, believing we were not more than a couple of miles from the travellers' bungalow, sent the guide ahead to get another bullock. After waiting for a couple of hours Dinshaw and I started, leaving the cart in charge of the driver. We found fires blazing in all directions, and on going up to one of them learnt, that they were lighted every night at that season of the year to prevent tobacco leaves, then being collected and prepared, from being stolen. This tended more and more to lead us astray, till at length we got a guide, and on reaching the bungalow found our messenger had never arrived. We sent out another on this occasion with bullocks, but he not returning was supposed to have lost his way. I started off at daybreak, afraid anything might have happened to our driver, a fine intelligent fellow supplied us along with the means of conveyance by the Thakoor of Bhownuggur. He had seen no one, and had sat all the night betwixt the living bullock and the dead,—the latter fearfully swollen, was lying on his back with his

formerly resident at Broach, and should have greatly liked to have been able to compare them with those at Surat. The inscriptions are stated to be quite legible, the dates to extend from 1654 to 1770.*

Broach is a place of very considerable trade, and forms the shipping port of Malwa, from which goods are received, and to which they are sent over distances varying from 100 to 300 miles, over roads so bad that it requires from 6 to 8 bullocks to drag a cart which will scarcely carry half a ton. The Cyclopean proportions of the vehicle, especially the wheels, and strength with which it is bound together, as well as the number of cattle required to draw it, indicate the difficulties to be surmounted on the way.

The fruit of the Mowra, or Mowa, very greatly resembling the common date, but more starchy and insipid, and less saccharine, is brought down in large quantities chiefly for the purposes of distillation, about 500 cart loads reaching every season. It yields a strong fiery spirit which is very often, indeed believed to be distilled from the petals of the flower,—which scarcely possess any of the bases of alcohol in sufficient quantity to yield any spirit at all. The chief exports are cotton, which is grown in large quantities all arouud ; its imports amount in value to betwixt £150,000 and £178 000, its exports to above a third over this.

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first set to work, just ten months from the time the first sod was turned for its foundation, an event the most important certainly that has occurred in the Western Presidency since the inauguration of our first railway on the 16th of April 1853. The importance of the first, like that of the second great occurrence just mentioned, seemed to have been overlooked by those most concerned in its results. The Governor, the Commander-in-Chief, and the Bishop, set forth on their usual holiday expedition to Mahableshwur, as our chariots of fire and horses of fire were about to rush forth on their mission, as if a week of Mahableshwur air had been to them matter of greater interest than the welfare of the millions of India ! When Mr. Landon let loose his myriads of dizzy wheels, he was the only one of all who had assisted in the glorious work now completed, to witness the first results his master-mind had conceived—his energy carried into execution. Only one engine was required at the outset; though the whole of the machinery was ready for spinning. it can only be brought into use as the natives, of whom five hundred will be required, are trained in the art of superintendence. The working of the engine and machinery was perfect, and we trust it may prove a favorable augury of the success of the final issue, that from first to last no impediment or obstruction worth mentioning has been experienced and no accident whatever has befallen either workmen or material. Mr. Landon may well be proud of the success that has thus far attended his exertions, and those who were clearsighted enough to discover his merits, and sufficiently stout-hearted to second his efforts, deserve, though in a minor degree, the cordial congratulations and grateful acknowledgments of the community, while rewards much more substantial than these are, we trust, awaiting them in the shape of munificent returns."

* Memoir of the Zillah of Broach, Government Records 1852. The statement is made by Col. Morier Williams, Surveyor of the Presidency for 1820. I do not know that the same thing still obtains that held good 40 years ago.

Broach,—the Barygaza of Arrian,—seems to have been well known to the ancients, and was probably, two thousand years ago, a place of much greater importance than it is now. The province comprises six pergunnas: the Baroach proper, the Unkulsur, the Hansot, the Jumboosur, the Ahme. The first of these was acquired in 1803 from Scindia by conquest, the other five by cessions from the late Peishwa. Unklesur and the Hansot by the treaty of Bassein, Dec. 1802; the three last by the treaty of Poonah 1817.

The pergunnah of Baroach itself, contains an area of 285.778 acres, or 447 square miles. A portion of the town stands on a high bank of earth about 80 feet above the river, which it on one side almost overhangs, with a series of large suburbs along and around the slope or base of the steep. It was in 1772 besieged by an army from Bombay commanded by General Wedderburne, who was killed under the walls: a few days afterwards it was taken by storm. After having been held by us for ten years, it was made over in gift to Scindia by order of the Bengal Government in 1783,—the withdrawal of the English being, according to Forbes, then Resident, matter of deep and universal regret by the inhabitants. The present English church stands in the breach through which our troops advanced.* I did not observe a single building capable of attracting attention, or any attempt anywhere at anything deserving so much as the name of architecture.

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* It was afterwards made over to Scindia in 1782, and was taken from him in 1803. I am not certain to which of the two captures the breach mentioned in the text was due. I take the fact from the journal of the visitation of the Bishop of Bombay, Feb. 1856. 'It was on the latter of these occasions that a large quantity of British property fell into the hands of our army, and became booty of war, Messrs. Bruce, Fawcett & Co., (now Remington & Co.) were the chief sufferers:—the question was referred to General Wellesley (the Duke) then on a visit of a few months duration to Bombay, and became the subject of a very admirable letter on the rights of besieging armies to all the property they capture. The following extract from the Despatches is worth quoting, even in a brief outline of the Journal of a hurried tour: if acrimony and ill-feeling were always thrown aside, how much more valuable work might we not get through with.

Camp, 31st Oct. 1803.

'1. I have had the honor to receive your letter of the 19th instant, with its enclosure, being the copy of one from Messrs. Forbes and Co., and Messrs. Bruce, Faucett, and Co.

2. As far as I am concerned in the property captured at Baroach, I am of opinion that the proposition of those gentlemen is very reasonable, and that it ought to be complied with.

3. In respect to the letter from those gentlemen, it might probably have been as well to have omitted all the injurious expressions and reflections which it contains.'

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6. The question respecting the property belonging to British merchants found at Baroach is, whether it is included in that reserved by His Majesty in his Royal Charter. Those concerned in the capture, I conclude, think it is; the merchants

Broach seems remarkable, if half the stories we heard were to be believed, for the length to which Hindo orthodoxy is carried out, and the extent to which it is occasionally practised on. As the slaughter of animals of all kinds is forbidden,—rats, mice and other vermin, as may well be supposed in a place so filthy, are plentiful. The Hillmen, who have no such prejudices on these points, make the abundance source of gain,—collecting all sorts of animals that come within their reach, provided they cannot be claimed as property; they take them to the wealthiest and most credulous Hindoo in the neighbourhood, and threaten to destroy them. Upon this hey are bought up and liberated, and severe haggling for the life of a more than ordinary vigorous rat being a case of constant occurrence. Those that have been once caught and set free uninjured—probably indeed with a gift of some grain for their good conduct,—are not difficult to recapture; and so on falling a second, or third, or any number of times into their hands, they become ransomed by some fresh simpleton. This indeed we were assured formed quite a branch of trade, and the money realized by individual speculators familiar with the ups and downs of rat life, were represented as astonishing.

The Nerbudda, which passes Broach, is even in the dry seasons a very noble river. It measures 450 yards from bank to bank when the tide is out, and nearly a third more at highwater: the tide rising about 5 feet. The harbour is very bad and the pier for passage-boats—if it deserves the name,—a mere mole or mound of earth, the portion covered at high-water ankle-deep of mud. There is a low island on the southern shore always submerged by the flood but attached to the mainland during the fair season, and beyond this there rises a second step to the altitude of about 30 feet, so as to be above the limits of the ordinary inundation, and only under water when the river is unusually high. The general rise during the rains seems to be about from 15 to 25 feet; it frequently gets the length of 30, and has been on many occasions known to be above 40 feet in height.

Judging from the map, Western India presents no more attractive field for irrigation than the magnificently fertile tract inland from Broach, and just

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think it is not. But surely there is no occasion for interference or acrimony of expression, on reflection, in urging the claim of either party.

7. Whatever may be the fate of the property hereafter, it is certain that if it had not been for the gallantry of the troops who took Baroach, it would never have come into the hands of the British merchants; and it might be as well, possibly, to refrain from accusing of injustice and unjustifiable measures, those to whom such benefits are to be attributed, only because they state their doubts respecting the real ownership of the property, which, according to the writers of the same paper that contains these accusations, is a question involving points of a peculiar and delicate nature.'

to the northward of the Nerbudda, and the large level space extending to the southward from the mountains to the sea, as far as the Taptee at Surat. Col. Grant, long superintending engineer in Guzerat, had strongly recommended canals in both districts, and Mr. Mackay, who went some way up the river on purpose to satisfy himself as to the practicability of the scheme, confirmed Colonel Grant's views, and renewed his recommendation for its early commencement. Anxious to obtain all the information I could on a question so important, I proceeded up as high as Junore, a village about 15 miles upwards by the road and about 20 by the river. Nothing could surpass the beauty and fertility of the country through which we passed, three-fourths of the fields were in crop, nearly the whole of the remainder thoroughly cleaned, or preparing for another sowing, and we hardly saw an acre of ground that did not appear to be under the highest cultivation. For water they were entirely dependant on wells—many of them from 30 to 40 feet in depth, and the people everywhere assured us, that no prices would be considered too high for a canal perpetually flowing. The results seemed so promising that the pursuit of the enquiry became quite exciting.

Alas for the result. We no sooner got within sight of the river than it became quite clear that a project of which so much had been said, and which had excited such lofty expectations, was utterly chimerical and hopeless.

Not trusting to the eye, or to estimate or conjecture, I had taken a theodolite with me. It was not difficult to plumb the bank by a long bamboo laid over it and a string and stone at the end. I found it here from 40 to 50 feet perpendicular, rising to an altitude of from 70 to 80, a little way landward, and this monstrous mass was to be cut through before our canal head could be constructed—the ground all down to the sea sloping so gradually, that the water could never have been got except at flood within 20 feet of the surface with a canal 50 feet deep. To the southward the bank sloped away very gradually for nearly half a mile, and deceived the eye as to its altitude; on using the theodolite as a level, I found that much within a mile the surface attained an altitude of 50 feet, which seldom seemed to sink lower than 30 all the way to the Taptee. The idea of a canal on this side was, therefore, nearly as much out of the question as on the other, the ground being infinitely less fertile; so here was an end of our project at once. How two authorities so eminent as those just quoted should have erred so greatly, or how any doubt should ever have been entertained of a fact so easily conclusively determined, is not easy to be comprehended.

I repeated my observations at a diversity of points for half a mile up and

down, to leave no doubt about the matter, but found the results so nearly uniform that there was no room left for hesitation.

My purpose was to have ascended the river by boat, to have examined the islands, and seen the celebrated Cubber Burr—the largest Banian tree in Western India, but I found the mode of conveyance so slow and uncertain from the frequent risks of grounding, that it was not to be thought of considering the little time I had at my disposal.

Jan. 23.—Left Broach for Kem-Chowkee, the next long stage towards Surat, about 7 A. M. As already stated the shore just southward is only about 10 feet above the low-water level of the river, and must be an island half the year and altogether submerged in floods. The land soon rises by a second step about 20 feet higher than this, or 30 above the river, and slopes very gently eastward to the village of Aclaiser; here the surface of the ground arises suddenly by a further step of 10 or 15 feet, and attaining the general altitude in all of 45 to 50 feet, and so continues all along. The character of the soil as much as the level of the surface here suddenly changes;—on the lower step throughout it is light and sandy, as if the more argillaceous of its components had been washed away: here it becomes at once stiff and clayey, more intracticable and less fertile than before. There is a very beautiful lake at the entrance of the village.

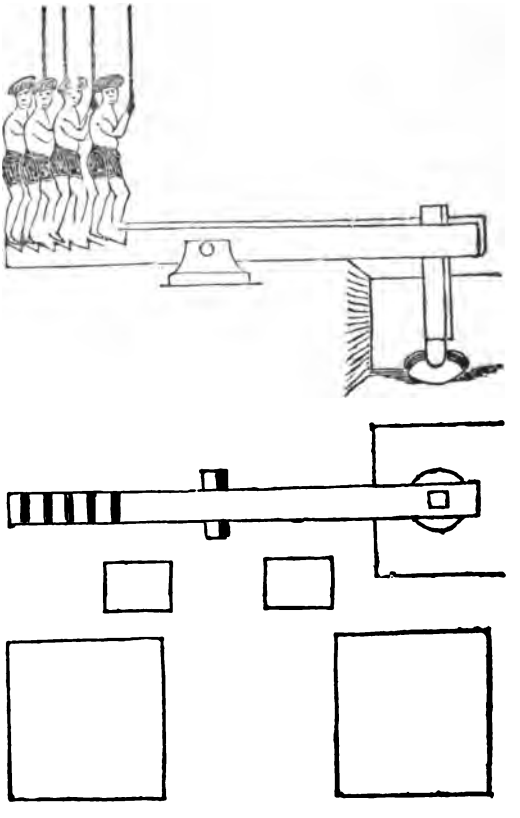
Palm trees, which had hitherto been in a great measure strangers, now began to reappear,—the Palmyra being the most plentiful (*Borassus flabelliformis*). One magnificent grove of these towering above the tamarinds, banians, and other round-topped trees, was peculiarly striking. Nearly all the wells here are more or less saline, with the exception of one of great depth some little way south of the lake. The steps and stone work leading to the lake on the side north of the public road are of a yellowish-brown coloured limestone, composed almost entirely of marine shells, a portion of the nummilite of Cutch, I imagine, found I was told on the margin of the Runn.

The place for travellers here is a large walled-in court or caravanserai, to which admission is given by a gate and archway. As it does not form a sleeping stage for Europeans, the accommodation intended for them is not very select.

Aclaiser is celebrated for its paper manufacture, and there are about forty paper mills in the village employing in all about 400 work people. These are generally paid by the piece—receiving so much for so many quires; each man being requited according to the skill and delicacy required of him. Some of them earn from 10 to 12 Rupees a-month, high wages for Goozerat. The paper is made from old gunny bags, waste hemp, broken cordage and

other long fibres, with small additions of spoiled cotton; but a very moderate allowance of this injures the strength of the goods.

"The mashing machine consists of a great wooden hammer, something like that of a fulling mill, only lighter – or that sometimes used for husking rice, or grinding charcoal for gunpowder. The accompanying diagram, rude as it is, will make this better understood than any description: it represents a native paper mill. The material to be pulped is thrown into a square stone vat, about three feet deep. In the bottom of this is a circular basin, with a roller-shaped piece of hard stone—commonly marble—on one side.




ELEVATION AND PLAN OF A NATIVE PAPER-MAKING MACHINE.

The hammer head diminishes in size towards the face, and makes a half grinding stroke against the stone. The shaft or arm of the hammer, so to speak, is about ten feet long—the fulcrum is about four feet and a half from the one extremity and five and a half from the other—on the shorter end it is flattened or divided into steps. Over this five or six persons stand each steadying himself by a rope depending from the roof on purpose. They tramp with one foot on the short end of the lever, throwing all their weight upon it and pushing it down by about six inches, the stroke at the other end being about 10 inches. About a hundred strokes are made a minute, or nearly two per second: the hammer end of the lever weighs about 390lbs. In the case represented, the grandfather, father, and three children, constituted the gang of trampers. The rags are mashed in about three hours, and then thrown into vats adjoining, after which they are treated exactly as at home, with this difference, that the frame in place of being made of wire is of fine slips of bamboo, and thi is laid loosely on the frame itself, and is thrown out of it on the flannel with th

houses perpendicular. The clay on which they have been built has given way, and the foundations slipped during the inundation or the heat which ensued, and the walls cracked, twisted and warped in every imaginable direction,—nothing but the strong teak framing binding them together has saved them from destruction. The streets again have for the most part been so ploughed up by the floods, that many of them present the appearance much more of deep watercourses than thoroughfares, and there can be no doubt that in the former capacity they have proved much more serviceable than in the latter, there being few portions of Surat which are not once every four or five years at all events navigable by boats.

The Castle of Surat is a strong, compactly built, rather striking-looking structure, overhanging the river, having four stout round-towers with curtains between. A fine flight of steps descends right under the western wall, over which merchandize and military stores used to be carried up and brought down. Immediately under its guns, in days of yore, Indiamen and large merchant vessels and ships of war were wont to ride at anchor: now steamers of light draught of water and native craft of no great size can alone cross the bar or ascend the river. On the landward side, the Castle is little more than half the height it is towards the Taptee: here it presents us with on outer and an inner wall, a rampart, wet ditch, raveline and glacis, but no guns. Within the inner gate is a neat quadrangular court. The Fort Adjutant and Commander of the Artillery reside in one of the wings of the building: their accommodations are neat, airy and commodious, and from their great height, and being roofed with bombproof, or masses of brickwork so considered where there are no bombs to try them, are peculiarly cool. The view from the window is particularly fine, commanding in one direction the windings of the river upwards by the walls of the city, and in the other its beautifnl reaches out to the sea.

The present castle was built in 1542, when Sultan Mahomed Shah reigned in Goozerat. When the Mogul Emperor of Delhi obtained dominion over the province shortly afterwards, the commandership of the Castle and government of the town were kept separate.* The King of Delhi maintained a fleet, for the protection of the seaboard of Western India: for the support of this three lakhs of rupees were annually drawn from Surat—the fleet itself fell latterly into the hands of the Siddees of Rajpore—so potent and flourishing shortly before our connection with it was the now decayed city of Surat, which threatens speedily to have its walls melted into the yellow waves of the Taptee.

* Extracts from the Memoirs of Jonathan Duncan regarding the History of Surat.—Papers presented to the House of Commons.

The native burying-ground is beyond the inner wall, at the further end of the city : graves are scattered about amongst the houses as if the inhabitants were indifferent even in this to Mahomedan usages. Here it is where the river, when swollen, first enters the city. The walls are for hundreds of feet together fairly undermined, and nearly ready to fall. The cause of the destructiveness of these floods is sufficiently obvious : the Taptee rising amidst steep rocky hills where rain falls with extreme violence, here makes on ordinary occasions a long bend like the letter C. round the city, and rises and rushes on with such rapidity and fury that it takes a short cut across the country and inundates Surat in its progress. In 1838 Captain Fulljames recommended that an open cut, the chord of the arch, should be made, to draw off the superfluous waters of the river, and the device for a time seemed to have succeeded : later floods have proved too much for it—and besides, the whole channel of the river is moving edgeways towards the city, and the water undermining the foundations of the walls. There seem at present no means of saving Surat from utter annihilation excepting by digging a new channel for the Taptee at a safe distance from the town, and in such fashion that it shall not from henceforth be able to quit its bed. Half the value of the property destroyed by inundations within the past half century would have completed all that was required : at present Surat, as just stated, is on the point of annihilation and the question is—is the cost of the cut equal to the value of the Town ?

A list of the Floods from which Surat has suffered would form an interesting portion of the annals of the city ; but in India scarcely anything worthy of being recorded is set down,—the memory of trifles is chiefly cherished, and the climate speedily effaces all the vestiges of even the most striking catastrophes. In 1810 both Broach and Surat appear to have been visited by inundations unusually disastrous, though infinitely less so than that which followed twelve years afterwards. In 1822 the Taptee, swollen by a long continuance of rain, began to rise on the 15th of September, and continued for three days to increase ; the water advanced so rapidly that some gentlemen only saved their horses by taking them up-stairs. By this time the flood had risen four or five feet higher than it had ever done before, extending to the eaves of many of the lower-roomed houses. Nearly 300 yards of the outer wall of the city were washed away, two bridges were destroyed, part of the wall of the Adawlut was carried off, and 400 houses are reported to have fallen at Ramdier. About thirty lives were lost, and about 1400 head of cattle were swept away. 2000 houses in all were believed to have fallen, of which above 600 were substantially built. On the 6th of August 1835 another inundation is recorded. The water began about two o'clock in the

Hic Jacit
SAMUEL EVANCE ANNESLEY
Honorabilis Viri
Samuelis Annesley, Angli—
Et Susannæ Uxoris, ejus, filius
Natus Martii 18 A. D. 1697—8.
Variolis corruptus eodem die An. 1702
Mortuis die 21.

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Hic etiam jacit
Frater ejus CÆSAR ANNESLEY
Natus 8vo. May 1700
Morbo spasmi 30 July sequentis
Mortuus
Cum Duobuosa bortivis.

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Here under lie the mortal remains of WM. WLKINS, Esq.
Late Collector and Magistrate of the Zilla of Broach,
In the *Bombay Civil Service*, who departed this life
On the 30th November 1820. Aged about 29 years.

As an Oriental scholar generally
The deceased was highly distinguished,
Having in early life acquired a taste
For the languages and literature of
The East, under the tuition of his
Uncle, the celebrated Orientalist
CHARLES WILKINS, LL. D.
His knowledge of the Sanscrit and
Persian languages was not excelled
By any of the Bombay establishment.
THIS MONUMENT.
Has been erected out of regard
To the memory of *Mr. Wilkins*,
By a few of his Brother Servants.

---

Here Lyeth Interred
The body of
ELIZABETH WYCHE
Widow and Relict of
Bernard Wyche, Esquire
Chief for Affairs of the Hon'ble United
British Company. Surat Anno. 1712
She was
A dutiful Child
A virtuous good Wife
A Tender loving Mother and true Friend
Very Compassionate and Abundant
in works of Mercy and Charity.
Was born
On the Island of Bombay
And dyed
In Surat
About the LIV. Year of Her
Age on the XXX. day of June
Anno Domini MDCXXXVI.

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Interrogas amice lector
Quid sibi vult grandior hæc structura responsum habe;
In hoc gloriabar satis quod alteram illam grandem continet
Superbit insuper quod una cum illa tegit generosos duos fratres
Fraterrimos.
Qui et in vivis fuerunt et etiam in mortuis sunt conjunctissimi
Alterum velis intelligas? lege a ibi
Intelligas velis alterum? lege hic
Dominus GEORGINO OXENDEN cantamus
Filius natu tertius D. Jacobi Oxenden Equitis
Ipse equestris dignitate ornatus
Anglorum in India Persia Arabia præses

Insulæ Bombayensis Gubernator
Ab illustri Societate pro qua præsidebat et gubernabat
Ob maxima sua et repetita in eam merita
Singulari favoris et gratitudinis specimine honestatæ
Vir
Sanguinis splendore rerum usu
Fortitudine prudentia probitate
Preeminentissimus
Cum plurimorum luctu obit Julii 14°
Cum plurimorum frequentia sepultus est Julii 15°
Anno Domini 1669.
Anno Ætatis 50.
Heus Lector !
Ex magno hoc vivo vel mortuo aliquid proficias.

The second—

Hic situs est CHRISTOPHERUS OXENDEN plorati
Exemplum vita sed vitæ morte ea ducæ
Intrat et exit hic inceptis animamque finivivit
Ille dies tantum numerare triginta valebat
Neu annos, nam raptim exigit mors rationem
Quæritis o Domini quid damni vel quid habetis
Lucri vos servum socium ; nos perdidit ille
Vitam sed qui contra occidat mors mihi lucrum
Exilt e vita April 18, 1659.

---

Hic Jacet
BARTHOLOMEUS HARRIS ARMIGER
Propugnaculi et Insulæ
Bombayensis nuper Prefectus
Et Pro Gubernatiore et Societate
Mercatorum Londinensiane
Ad Indos Orientalos Negotiantium
Surato Presidens
Et Conjux sua ARABELLA
Ino Maij Decimo
Anno { Etatis XLV.
Domini MDCXCIV.
Haec Martij Vice Secundo
Anno. { Etat XVIII.
Domini MDCLXXXVI.

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Hic Jacet BEN. GARY
Filius Unicus HENRÆ GARY
Patris et MARIÆ Matris sue qui
Hinc ami gravit ad eternas mouslones
19th Aug. Anno 1658
Anno Etatis 14.

---

Lo where this silent marble weeps
A Friend, a Wife, a Mother sleeps
A heart within whose sacred cell
The peaceful Virtue loved to dwell
Affection warm, and Faith sincere
And soft Humanity were Here
In agony in death Resigned
She Felt the Wound she left behind
Her infant Image here below
Sits smiling on a Father's Woe ;
Whom what awaits while Here she strays
Along this lonely Vale of Days
A Pang to sacred Sorrow dear
A Sigh, an unavailing Tear
Till Time shall every grief remove
With Life, with Mercy and with love
In Memory of GERALDINA JAMES
Wife of WILLIAM JAMES, Esq.
Of the Council of Surat. Who
Departed this life the Thirteenth day of September
1775, Aged Thirty-four years and seven months.

little time near the residence of the party referred to, when I received an invitation as from an old friend. It was one of which I was unable to avail myself, but I felt very gratefully the kindness intended an utter stranger. On another occasion I came across a camp in the wilderness, and conceiving that the occupant could give me some information that I desired, I sent in my card, I was not only immediately received with the most cordial hospitality, but my commissariat arrangements not having been considered the most judicious possible for the journey before me, I found my people provided without my knowledge so as to make up for deficiencies. After a long day's journey sometime after this, I again passed another domicile on my way to a rather unpromising rest-house, and availed myself of a horseman of my Bhownuggur escort to send in my name. The goodman of the house, a distinguished public officer, was immediately in quest of me, and we continued for half an hour and until quite dark goose-chasing each other, till at length I found myself welcomed to a handsome dwelling-house abounding in all the elegancies of civilization, with dinner ready laid as if I had been looked for, and my quarters for the night or period of stay all duly arranged, by parties who had never seen me before, and to whom I had no introduction. The provision arrangements, in which certainly I could not compliment my own prudence, were always the first looked after. On one occasion, nearly the only one in which I had a formal introduction, I was visited immediately and asked to make the residence of the gentleman to whom I had been introduced my home, and on intimating that I must be off again next morning, and could not think of troubling them on so short a visit, a party was invited on the instant to meet me, and a pleasanter one I have rarely met. Next morning, long before the faintest streak of dawn, my friend was with me attended by a servant with the residue of the delicacies and substantialities of the previous day's feast, packed up with that neatness and skill which the kindness, consideration and care only to be looked for from the best of housewives. These matters may seem of small account: they are not felt to be such by a stranger on his first visit to the interior. And though the principal part of the gratification they confer arises from the sense of kindness unexpectedly received, it is no small enjoyment after spending three or four nights on end in filthy verandahs, sleeping on a charpoy at least a foot too short, and feeding on native bread and butter, boiled rice and vegetables, to have a good warm bath, a nice bedroom and dressing-room, elegantly furnished rooms to look at, and a good dinner, which seems far costlier and even more luxurious than it is; above all, to have an evening's rational conversation about

the country being traversed, to hear the music of a female voice, and be awoke in the morning by the sweetest of sounds : " the lisp of children, and their earliest words."

## APPENDIX.

The following is a list of the Temperatures in detail as noted by Dinshaw, the companion of my journey, and interpreter and assistant observer :—

*(Observations on the Tour to Kattiawar and Guzerat.)*

Surat, 3rd January 1855.....High water at 1. P. M.

Taptee water, Temperature 76·2
2·0
Corrected..... 74·2 } at 4½ P.M.

75·8
2·0
73·8 } Temperature at 21 ft. deep Corrected.

Surface of water Temperature. 74·5
2·1
Corrected. 72·5

Bottle No. 3. Surface water Temperature. 75·4
2·0
73·4

Bottle No. 4. and water 10 ft. 4 in. deep. Tem. 6 miles from Surat. 73·0
2·0
71·0

Landed at Gogo, 4th January..... 2 P. M. Barometer 30·146 Temperature. ..... 73·0
Bhownuggur, 4th January..... 10 P. M. " 0·60 " ..... 60·0
" 5th January ..... 6¼ A. M.

| | Temperature | Dew point. | Dry. | Wet bulb. | |
|---|---|---|---|---|---|
| Dan. Hygrometer.. | 66·0 | 43·0 | 55·0 | 50·0 | |
| Nessuro, 5th January..... | 3½ P. M. | | Barometer. 30·000. | Temperature | 820 |
| Wulleh, 5th January..... | 9¼ P. M. | | " 29·970. | " | 692 |
| Wulleh, 6th January..... | 6½ A. M. | | " ·970. | " | 59·2 |

Temperature in the open sky, 54·0

Dry, 58·0 Wet, 52·0

6th January A. M. Barometer 30·022. Temperature 62·8.

Ranpoor, 8th January..... 7¼ A. M. Barometer.... 30·058 Temperature.... 55·8
Choora, 8th January ..... 1½ P. M. " ... 29·758 " ... 77·8

Dry, 77·7. Wet, 60·5.

Kharva, 8th January..... 8¾ P. M. Barometer... 29·934. Temperature... 71·0
" 9th January..... 6 A. M. " ... ·972. " ... 70·0
Wudwan, 9th January..... ..... ... 8 P. M. " ... 30·104. " ... 67·0

Dry, 67·0 Wet, 61·5.

Wudwan, 10th January ..... ..... 9½ A. M. Barometer... 30·070. " ... 70·5

Dry, 73·3 Wet, 61·5

Wudwan Well, No. 1, Water 20 feet deep and 10 feet from the surface of the ground to the water (¼ mile S. W. of Wudwan.)

At 40 minutes past one o'clock. Temperature of the surface water ..... 77·0
2·0
75·0

it is at least 30 feet below any depths hitherto penetrated. We need not, however, venture on any guess. The facts as observed disclose masses of alluvium that astonish us. In Kattiawar, from Gogo round to Bhownuggur, and from this again along by Wullee and Wudwan, and so across the Runn as far as Dolka, the soil is comparatively light and sandy—not much given to deep-rutting where roads exist, or to be grooved out into ravines by torrents. The river banks are nowhere more than from 6 to 10 feet in height—the gravel filling the bottom of the channel being apparently from a deeper scour or scarping out. I was not able to perceive any greater trace of stratification than might be accounted for by an occasional change in the course of the stream when the old gravel beds rose, and in many cases were cemented together by the infiltration of limewater, into a species of concrete or conglomerate. To the north-eastward of Wudwan matters begin to change: the soil becomes more argillaceous in texture, and lighter and more yellow in colour, with occasional patches of the Regur, or true black cotton soil, extending to the depth of a few feet only, and which, as has already been shewn, is merely a variety of the yellow, or brown soil transformed. The gravel and sand in the rivers up to this time consist either of trappean minerals and small portions of rounded trap or particles of abraded sandstone. The clayey soil further on contained scarcely any solid particles whatever. The banks of the Taptee and Mahae shewed clear indications of well-defined stratification, though not by any means to the extent that might be supposed from the appearance presented by them to the eye at a distance. The gradual changes in the soil from the surface downwards often affording the semblance of stratification, where a more careful examination shews that none exists,—a circumstance strikingly characteristic of the black soil itself.

The delta and the banks of the Nerbudda is entirely silt from the surface all the way down to the channel of the river, and there are at least three well defined beds of sand. The upper portion of the alluvium splits up into well-marked flakes from ¼ to ½ of an inch in thickness, which can be separated without trouble with the knife. The same is the case to a considerable extent with the Taptee both above and I believe indeed under and around Surat, there is a bed of trap-sand from three to four inches in thickness all along about 10 feet below the present surface of the country. Familiar as we are in India with the enormous masses of earthy matter that accumulate *in situ*, and which are obviously derived from the decomposition of the rock below, so as to be in no way startled by almost any amount of soft earth, without assuming aqueous deposit or transportation; and it is quite clear that the clay soils of Goozerat have all been

piled up beneath the surface of comparatively tranquil water: that in reality they are old marine formations of unknown geological date. The extent to which water in India, about the close of the rainy season, becomes impregnated with fixed air, occasions such a rapid solution of all calcareous matter, especially in the fine attenuated form of shells, that we have in a few years all traces of organic remains such as might guide us obliterated, unless where these are preserved by kunkerous concretions;—and these at all times are most worthy of being subjected to the most careful and unremitting attention. The town of Broach itself is built on an eminence of the same apparent structure as the country around, and this would lead us to believe in the operation of extensive denudations which have removed from 30 to 40 feet of soil, from some cause or other, leaving this single eminence at its original level.

From Broach across the Nerbudda towards Surat, and so all along by the seashore, and again a considerable way up the estuary of the Taptee, we have beautifully distinct evidences of two independent upheavals—the lower one probably corresponding to those along the shores of India on both sides from Bombay all around, such as have already been referred to in treating of the supposed submergence of Wullee (see p 34.) I am not conscious of having met with anything around Bombay—to which my experience is very nearly confined—corresponding to the second, or third shelf; I should think it more than likely that similar appearances might be met with near the mouths of the Mahae and Sabermuttee, though I had no means of determining the fact. Conspicuous amongst the contents in the gravel of the Nerbudda are small particles of the agates and cornelians found in such profusion in the Rajpeepla range of hills, a little way up the river: the appearance of these, shining like rubies in the sun, is singularly beautiful. The waters of all the four great rivers which discharge themselves into the Gulf of Cambay are, excepting in floods, pure as crystal, tolerably free apparently of all soluble matter, and bearing scarcely one particle of earthy contamination along with them. Viewed from the crests of their high banks they seem a bright clear cerulean blue,—the reflection of the sky above; to those in the habit mostly of observing wooded rivers, and looking at them from near the line of their margin where the objects on the banks are chiefly reflected, and not the sky itself, the appearance seems singular. The Nile and Ganges, so far as I know, are at all seasons contaminated by clay for many miles up from the sea.

In many parts of Kattiawar the surface of the soil was covered with an efflorescence of saline matter, apparently nitrate of lime, and here considerable quantities of nitre are occasionally manufactured from the soil.

power they appear like a central nucleus. In progression this *infusorium* becomes slightly elongated or lozenge-shaped, obtuse posteriorly and most deeply notched at the side. It has no appearance of celia; its movements through the water are rapid and waddling, frequently turning over and momentarily altering its shape, wheeling about in circles or advancing in straight lines, never retrograde, in length it is the 860th part of an inch, and the diameter of its transparent and red granules does not exceed the 18,000th part of an inch. When dead it assumes a subglobular shape and turns green."

I commence with the following somewhat lengthy extract translated from the *Annales des Sciences Naturelles*, 1855:—

"*Memoir on the Animalculæ and other Organic bodies which give a red colour to the Sea.*

"Navigators often meet at Sea with large patches of the water of a colour different from the ordinary colour of the sea, and these patches are seen in the form of bands, and in all the intermediate shades between yellow, blood-red, and brown. They are often of very great extent, and are separated at their edges distinctly and abruptly from the clear water beside them. They have been frequently taken for shoals, although they have almost always been seen in those parts where the water is of considerable depth.

It has been long known that this colour does not appertain to the water itself, but is produced by substances held in suspension in it; the nature of these substances has, however, been generally misunderstood. It is a common belief among seamen that it is the fry of fish. Naturalists who have had opportunities of examining these phenomena have thought, and correctly, that they are organic bodies, but having but seldom good microscopes with them they have been unable to determine with precision the nature of these bodies.

Having had an opportunity the beginning of last year of examining a case of this kind, I was desirous of making myself acquainted with the various facts on the same subject related by navigators and naturalists. I have collected more than fifty of these relations. The comparative examination of all these observations has enabled me to determine in many instances with certainty, and in most of the others with considerable probability, the nature of these various organic bodies which produce this colour in the water. It has moreover led me to a conclusion which appears to me to interest physical geography as well as natural history itself; and this is, that these colorations are, for the most part, permanent in certain localities, where they are reproduced generally at the same time of the year. This will be clearly shown from the special examination of each particular case where these colorations have been observed. To make this study the easier, I have classed these observations according to the certain or probable nature of the cause which produced them.

Water coloured by various species of the small microscopic Algæ called *Trichodesmium*.

| | | | |
|---|---|---|---|
| Do. | by the *Cetochilus Australis*. | Do. | by the *Biphores*. |
| Do. | do. *Greinotea*. | Do. | do. *Protococcus*. |
| Do. | do. *Noctiluques*. | Do. | by animals not yet known. |
| Do. | do. *Bacillaires*. | | |

And other colorations the nature of which are still unknown, but probably caused by matter carried into the sea from Rivers.

An observation made by Mr. Ehrenberg regarding the first forementioned coloring matter was at Tor in the Red Sea, as follows:—

"The 1 th Decr. 1823.—I saw the surprising phenomenon of the water of the whole bay which forms the Port of this town coloured of a blood red. The water

outside of the coral reefs preserved its ordinary colour. The small waves of this tranquil sea bore to the shore during the heat of the day a mucilaginous matter of a blood-red colour, and deposited it on the sands, so that in the space of half an hour all the bay at high water was bordered with a red band several feet in width. I took up some of the water in glasses and carried it to a tent I had near the sea. It was easy to discover that this coloration was caused by small flakes barely visible, which were of a greenish colour, sometimes of a deep vivid green, but for the most part of a deep red, the water they floated in being perfectly colourless. I observed too that during the day these flakes remained on the surface of the water in the glasses and that in the night, and when I shook the glasses they went to the bottom and sometime afterwards would mount again to the surface."

About 20 years after this Mr. Dupont observed this phenomenon in the Red Sea also :—

"The 15th July 1843 we were abreast of the town of Cosseir; the sea was red the whole day, and the next day also till noon, at which time we found ourselves off Tor. During this interval the Packet had been going 8 knots an hour and had run a distance of 256 miles. Mr. Dupont collected some of this colouring matter on a strainer, and Mr. Montague discovered in this substance the same characteristics of the plant discovered by M. Ehrenberg. These observations made with the greatest care possible leave no doubt about the results arrived at."

From Cook's first voyage :—

"9th Decr. 1763 we observed the sea covered with large bands of a yellowish colour, several of which were a mile long and 300 or 400 yards broad. We drew up some of this coloured water and found that it was filled with an innumerable multitude of atoms, each terminating in a point, and of a yellowish colour. None of them were longer than $\frac{1}{16}$ of an inch. On examining them through the microscope they appeared to be bundles or fasces of little fibres interlaced with each other, and resembling a good deal the *Nidus* of these Aquatic flies called *Caddices* Messrs. Banks and Solander could not make out whether they were animal or vegetable substances, or what could be their origin, or what they could be designed for. We had seen the same phenomenon before when we first made the coast of South America."

Kotzebue in his first voyage round the world relates the following :—

"The 6th Decr. 1815 we were in the neighbourhood of Cape Frio, of which I had, according to my instructions, to determine the latitude, but as the continued bad weather there rendered this observation impossible, we directed our course to the Island of St Catherine. The next day we observed on the surface of the sea a waving band of a dark brown colour about 2 fathoms broad and extending in length as far as we could see. At the first sight of this phenomenon I took it for a shoal. We lowered a boat and Mr. Wormscloid went in it and brought on board some of this coloured water, and we found that the colour was caused by myriads of small crabs, and the seeds of a plant which our naturalists think grows at the bottom of the sea. This observation, very imperfect as to results, was completed satisfactorily by the two naturalists of the expedition, Eschscholtz and Adelbert de Chamisso. The 7th Dec. off the Brazil coast we sailed across a long yellow band some fathoms in breadth. We drew up some of the water in a bucket, and observed that the colour was produced by a vast quantity of very small thin yellow filaments about $\frac{1}{12}$ of an inch long. With the microscope we saw a number of transverse divisions in each of these filaments. Two days afterwards we saw similarly coloured bands in the sea. On the 10th we sighted the Brazil coast."

incident here. It appeared quite a windfall to the poorer classes, who gathered up such as had not become decomposed with great eagerness."

This state of matters extended, I am assured, at least forty miles out to sea, and while the native theory of the fall of a star is that which will least readily be admitted, I am at a loss what theory to adduce to account for the phenomenon.

I observe from my journal that the 23rd January, the date at which this extraordinary appearance was met with, was near the close of a periodic atmospheric perturbation of unusual violence. It prevailed all over India, and was felt from Ceylon to the Mediterranean Sea. I am very far from assuming that luminous appearances of the sea have anything to do with the condition of the air, but there are three of the cases that I have enumerated where they have occurred coincidently and all that can be said of the others is, that I have no record of what the state of the weather then was. It would be very unsafe, however, on this ground to assume the want of coincidence. Everyone is aware of the susceptibility of the birds of the air and the beasts of the field to atmospheric influences, and it is quite possible that the inhabitants of the deep may be as much so. What we want is more information on the subject, and I place in your hands my humble mite that I may not be blamed for at once complaining and failing to contribute.

The following are from the Journals of the Bengal Asiatic Society for 1854 and 1855 :—

"Captain Bowen of the P. and O. S. Str 'Bengal' has obliged me with the following note of a tract of white milky sea passed through by him on his recent voyage from Aden to Ceylon.

Monday, 16th January, 1854.

At 7 P M ship entered into a perfectly white milky sea, cloudy on the horizon but perfectly clear; bright star-light; moon half an hour from rising.

Stopped and tried for soundings 90 fathoms. No bottom.

Density of the water before entering that strange appearance 11°. Density of the water when sounding 14°.

| | | |
|---|---|---|
| Sympiesometer, | 29° | 90 |
| Barometer, | 30 | 12 |
| Thermometer, | 80 | 0 |
| Latitude 11° 59 N. Longitude, E. | 59 | 2 |

I may remark that previous to entering this strange sea, there was a moderate ripple on the water and after leaving it also, but smooth like oil when in it.

(Signed) JOHN BOWEN,
*S. S. 'Bengal', from Aden to Ceylon,*

In his letter Captain Bowen says: "I once saw the like on the Malabar coast fourteen or fifteen years ago, but not at all to the exteent this was; for the horizon (on this occasion) was in the same state as the water alongside."

I have once before recorded (Proceedings for March, 1847, Journal Vol. XVI p. 382), an instance in which this milky luminous appearance was seen off the Cape of Good Hope, and Dr. Buist in the Transactions of the Bombay Geographical Society has also recorded, an instance in which a Company's Steamer from Bombay to Aden passed through a large extent of it; and it is I think mentioned also in Horsburgh and some modern books of voyages? but we are so ignorant to what it can be owing, that every accurate notice of it is worth registering. If we could obtain some bottles of the water, carefully put up and corked, we might perhaps, between chemical testing and the microscope, arrive at some results worth knowing; unless the appearance be purely electrical phenomenon?

*Hong Kong, June 6th*, 1855.

*To the Secretary of the Asiatic Society.*

"DEAR SIR,—A short time since, I had an opportunity of examining some Nos. of your Journal and find (Jour. No. II. 1854, p. 206) that you solicit farther notices of such phenomena as Capt. Bowen has given you on the preceding page. Accordingly I send you the following copy of notes taken immediately after witnessing the phenomena they describe.

Ship 'Shooting Star' bound from N. Y. to Hong Kong, Thursday, July 27th, 1854. Lat. 11° 27 N.; Long. 105° 40 E.

7½ P. M, A little cloudy on the horizon, but very clear bright starlight, fresh breeze. Air 73° F. Ship entered light-colored water, and in about 15 minutes the sea as far as the eye could reach appeared like an immense field of snow, no ripples, but smooth like oil, so that when the ship's bows threw up a ripple it immediately fell back to its former level. Orders were given to heave the lead, when 60 fathoms found no bottom. The light from the water illuminated objects on deck and dimmed all stars within 20° of the horizon. Looking over the widest part of it, the horizon appeared like a dim Aurora Borealis. Ship's head North, sailed 10 miles through this patch, then ½ a mile through ordinary colored seawater, and again through another patch of 10 miles of light water: limits of light water well defined

Dipped up deck a tub full of this water, and found it 78½°, same as water in the morning. The tub presented a brilliant sight, being filled with bright self-luminous serpentine animalculæ, varying from half an inch to five inches in length. Examined carefully in the hand, by the light, they were found to be nearly transparent, about the size of a hair in the middle, and tapering a little towards each end; of a jelly-like substance which burnt in the candle with a red light, and crisped like burnt whalebone. A few were differently formed. Two were found capable of propelling themselves through still water in a tumbler. One of these was in the form of a concentric ring half an inch in diameter, with teeth-like projections on the inner-edge, and seemed to propel itself by contracting the diameter of the ring: it was preserved alive about 36 hours.

This examination satisfied me that the light is emitted by animalculæ, but I am most anxious to know if scientific men can explain *why* it appears at *certain times* and within such *prescribed limits*.

Your's truly,

A. R. WRIGHT,

*Surgeon*, P. and O. Co.'s

S. S. "LADY MARY WOOD."

one story high, chiefly built with mud or sand stone. The streets, if they can be so called, are exceedingly narrow and dirty ; it is defended on the Western side by an insignificant fortress or rather wall with loop holes for musketry, flanked at every 60 yards or so with round towers, leaving the other three sides of the town entirely unprotected ; the place is governed by a Persian Khan, who collects what little revenue he can from this impoverished place, which is sent to the Government of Shiraz, but as there is scarcely any trade carried on, except in salt-fish, tabacco &c., nor any taxable property, of course the revenue must necessarily be very small if not nominal. After a short visit to this miserable town, redolent with odours not of the most agreeable kind in the world, backed as they were by a more than ordinary proportion of squalling children, and yelping curs, I was as may be imagined, glad to get out of the place, and wander away alone in quest of the extensive ruins and sculptures with the Persepolitan character, which Morier describes as still to be seen at Tahrie, " besides two wells, pierced to a great depth, and a building sufficient for stabling a hundred horses; " after a quiet ramble of some two or three miles, I accidentally stumbled on the ruins, my attention having been first directed to some large pieces of prostrated pillars, together with broken capitals, blocks of hewn stone, and mounds which were scattered in endless confusion over the whole surface of the ground. In fact the surface for some two or three miles in extent, was one mass of shapeless heaps of rubbish, which however clearly indicated that here were the remains of a once opulent and populous city. It is now " a desolate wilderness, level down to the ground without " an inhabitant ; its foundations fallen, its walls utterly broken, and their temples levelled in the dust, the houses shattered in pieces like the wreck of a vessel on the Ocean, and now strewn over the Plain as fragments on the troubled waters ;" there is nothing now existing to denote the site, save huge mounds covered with prickly thistles, briars, and coarse grass, which completely hide the ruins from view, so that, it was difficult to discover them, and were it not for the broken shafts of pillars before reverted to, I should have been utterly ignorant. I was standing on a spot that had once been tenanted by industrious men, and what may have been the emporium of this part of the world, perhaps ages since, when the Persian Gulf was in fact the high road for the trade of India, and China, and Ships conveyed costly merchandize to the Banks of the Euphrates and Tigris, at the time the mighty, but now fallen Babylon, and the still more ancient yet majestic city of *buried Nineveh* "*(the earthly Queen)*" swayed the destinies of the world, and were in the full height of their splendour and magnificence, and whose merchants as we are told by the Prophet Nahum were "multiplied above the stars of heaven." But I am digressing from my subject, so will now return to it and inform the reader that after wandering about these most interesting ruins for some hours, without being able to discover any slabs or stones with inscription of any kind on them, whether of the arrow-headed or Persepolitan characters, as Morier says do exist here, and moreover having no implements or men to excavate the ground, I reluctantly left and proceeded towards a Hill nearly a mile off, rising about 200 feet abruptly from the plain, on the summit of which

I perceived, like the Acropolis of Athens, a building which seemed to be a fortress or temple, though in a dilapidated state. On reaching the base of this Hill, I could see no road or pathway leading to it, so had to scramble up an almost perpendicular cliff the best manner I could, over stones and crumbling soil, till at last I reached the top, which I found was a small plateau about a quarter of a mile broad, connected to the main chain of mountains, by a narrow strip of land, or Isthmus, a mile or so in length, and on the verge of a precipice overlooking the plain below facing the sea, stood the ruins of a large quadrangular Building of well cut stone, apparently of Mahomedan Architecture. The roof had fallen in, but the walls were in a good state of preservation, and the arches of the windows and door ways were pointed, not dissimilar to the Gothic style. The entrance was on the north side and this opened into an apartment about 80 feet long and some 60 wide, and from the appearance of the structure, I should say it had been used as a mosque or temple. On the left hand of the entrance and close to the side wall, was a flight of steps led into a large vault, or dungeon, about 100 feet long and 50 feet or so broad, excavated out of the solid rock, which I concluded might have been a reservoir for water or the stable Morier speaks of, as large enough to contain 100 horses, though I should hardly conceive it could ever have been used for the latter purpose, as the position on the summit of a Hill could never have been favorable for such a purpose. I regret I was unable to explore this cave thoroughly, in consequence of the darkness, besides, the loathsome and sickening smell that issued from it, owing to its being tenanted by myriads of bats. Near to this vault, was a well about 5 or 6 feet in diameter, sunk in the rock to a vast depth; a stone thrown down took some seconds in descending, and from this circumstance, I should conjecture it to be about 300 feet deep; it was however destitute of water, and the noise the heavy stones made as they struck the bottom, echoed like distant thunder, and I could even hear the sound rumbling gradually away in the distance, as if there was a subterranean passage leading perhaps out of the base of the Hill, for the purpose of conveying water to the inhabitants of the city; this no doubt is one of the wells Morier mentions. The ruined mosque stands amidst heaps of rubbish or debris of masonry, and this narrow plateau, must have been at one time used as a burial place; for large sepulchral stones were seen strewn about in all directions, in the greatest state of confusion, as if the graves of the dead had been ransacked and disturbed by some ruthless hands. These monumental slabs were of sand stone, all hollowed out; they were of an oblong form, about 4 feet long, 2 broad and 2½ feet in depth, many being in a sadly dilapidated state, broken to pieces in fact, but a few were however found almost perfect, having received little or no injury from time, or the hand of man, with the exception of a hole knocked out at one end, and curious to relate the whole of the stones found had the same defect, for what reason, it is imposible to conjecture unless it was done in the hopes of finding treasure secreted within; but why all these monuments, if they were really so, should have been hollowed must be left to the antiquary to determine, for it is quite beyond my comprehension, they were most beautifully, and very elaborately

language of scripture and the appearance of the caves themselves that the majority, if not all of them, were the abodes of the living, not of the dead, and in proof of this he quotes a verse from the Prophet Jeremiah, 'O thou that dwellest in the clefts of the rocks, that holdest the height of the Hill, though thou shouldst make thy nest as high as the eagles, I will bring thee down from thence, saith the Lord ;' " Kennier and Morrier also in their travels in Persia frequently mention the existence of caves hewn out of the solid rock, and the former states that he saw several, on the western brow of a Hill at a place in the North of Persia called Margara, and that the natives know nothing of their history, they say that they are so old that no tradition has ever reached them, either with respect to the time when, or purposes for which, they were excavated ; there are no sculptures,nor will the caves either in magnitude or beauty bear the slightest comparison with those of India. He further says that Captain Grant in his travels on the Mekran Coast, saw in a valley on the north side of Tiz, the ancient Tiza of Ptolomey, in the Bay of Churbar Lat. 25°. 16' north, and Long. 60. 40. East, some caves, which had been excavated on the side of a Hill, about 100 feet or so above the base ; they were about 12 feet in diameter, and seemed to have been a Hindoo place of worship, as in one of them, was an altar on which a lamp had been burning, with marks of an animal having been killed in it ; "I am therefore of opinion that from these facts, the numerous grottoes I saw at Tahrie excavated out of the face of an almost perpendicular cliff, were most probably used, as in Moab, not only as dwelling places for the living, but also as places of sepulture, although I made what enquiries I could from the Natives about these caves, and the ruins, yet I could get no light whatever thrown on the subject, for the present inhabitants seemed to be utterly ignorant of anything regarding them ; they had no traditions of the existence of such a city, nor did they know why the caves on the sides of the mountain were excavated. They shewed such apathy in fact, about the whole matter, that I left them in disgust mingled with pity, for I could not help thinking how deficient in energy, must this race of men be, from those once inhabiting the spot, who had erected stately palaces, mansions, temples and whose streets must have thronged with thousands, whilst their commerce no doubt made it a flourishing, as well as one of the richest ports of the world. But now all is laid waste, the hum of man is barely heard, even over the rippling surge, and naught now exists to mark the site, but shapeless mounds and fragments of Pillars. I remained till past sunset wandering over this scene of melancholy desolation, and it was only when darkness began to close in, that I reluctantly quitted the place, but with the hopes it might be my fate to visit it again, for time would not then permit me to investigate more minutely those interesting ruins, which seem so little known to the world. I feel confident from what I then saw, that innumerable antiquities and sculptures might be discovered, which would throw some light on the history of a once great city, now enveloped in mystery. My opinion is that these ruins must be the true site of the ancient Siraff, (a port of consequence and the centre of an Oriental commerce in the 9th century of the Christian Era) and in this I differ widely

from Kinnier, Buckingham, Morier, and others, who say it is situated lower down the Gulf at the foot of a lofty Hill called Charack, (the Mount Ochus of the ancients,) near the small town of Cheroo opposite the Island of Gese corrupted to Khen but as no ruins of any kind or of any importance have ever been found there, by those who have visited the place, still further confirms my belief that the present Tahrie, and not Cheroo, is the idendical site of Siraff, and it is also my firm conviction, that this Port was at one time the grand emporium of this part of the world, long ere the Island of Ormuz, and the town of Gombaroon became the great marts of trade, for in the port of Siraff, vessels anchored laden with the richest products of India, Ceylon, China, the Eastern Seas, Southern Arabia, bringing too, the Myrrh, Gum, Frankincense, Ivory, and Gold dust, from Africa, and this extensive traffic was chiefly conducted by the Arabians ; " who we are told were for ages the great carriers of Europe, and did more than either the Greeks or Romans with respect to the commerce of the East; and in such a manner that they kept out all others from navigating those Seas, and thereby drew an immense profit to themselves, for the Indians brought by land to Cabul and some other places, and the Arabs by sea to Siraff and Bassorah, all the commodities of India, and China;" Siraff was conquered in the year 1320 by the Shah Kodbaden and the trade was afterwards transferred to the Island of Gese or Khenn, from which date may be considered the rapid decline and ultimate downfall of this ancient city; it never afterwards recovered either its commerce or its opulence, and it must have been gradually deserted by its inhabitants, as being no longer " the resort for foreign Merchants." Siraff is spoken of as a great place of trade in A. D. 915 by Abu Siedd Hussain, an Arabian; Eba Wahab also says that he dwelt at Bussorah and when that city was sacked by Aboo Sied A. D. 893 he fled from that town, and came to Siraff, where he saw a ship ready to sail for China, when the humour took him to go on board this vessel, and in her he went to China. This merchant accurately describes the Red Sea, and he states that the ships of Siraff when they arrive in this Sea, put into Juddah where they remain, and their cargoes are then transported to Cairo or Kehira, by ships of Kolzun who are acquainted, with the Navigation of the Red Sea, which those of Siraff dare not attempt, because of the extreme danger, and because this sea is full of rocks at the water's edge, because also upon the whole coast, there are no kings, or scarce any inhabited place, and in fine because ships are every night obliged to put into some port of safety; for fear of striking upon the rocks, they sail in the day time only, and all night ride fast at anchor. Morier also relates a curious story similar to Whittington and his cat, which may not be uninteresting if I here quote it."* An old woman who lived in the town of Siraff with her three sons, who turning profligate, spent their own patrimony and their mother's fortune, abandoned her, and went to live at Gese or Khenn. A little while after a Siraff merchant undertook a trading voyage to India, and freighted a ship. It was customary in those days, that when a person undertook

* I merely quote this curious story of Morier's as showing the important trade that was carried on with Siraff and India in remote ages ! !

thenes, who had a ship of the same burden, sailed further and examined the maritime Coast of Arabia. Hieren however excelled them both, for he sailed quite round the Chersonese into the Arabian Gulf (Red Sea) and so to the opposite Coast of Egypt. The source of the great wealth of Palmyra, was the share it had in the commerce of the Indies, the goods were carried by sea through the Persian Gulf to the mouth of the Euphrates, or perhaps little higher up, and thence they were sent by land in caravans, for some 100 miles through the desert, to Palmyra, which stood one day's journey from the Euphrates, 127 miles from Damascus, and at 203 from the Coast of Syria, by the ports of which, the goods were dispersed to all the different parts of the Roman Empire, that did not immediately correspond with the harbour of Alexandria; from the time of Adrian to that of Aurelian the space of 140 years, the city increased and flourished. Aurelian, in a fit of revenge made himself master of the place, and caused the inhabitants of the city to be destroyed without mercy; this dreadful destruction of Palmyra happened A. D. 272. " Dr Crichton also informs us that of " the different countries that traded with Arabia, of the rates of exchange, relative amount of exports and imports, we are left without any precise information; that the balance of trade must have been in favor of the Arabs, we may infer from the rich dresses, and gorgeous luxuries, which attracted the wonder and cupidity of all strangers; from their geographical position they became the centre of all traffic, between India, Africa, and Europe; on the western shores of the Red Sea, the chief marts were Arsinoe, Myos, Hormos, Berenice, Ptolemais, Theron, and Adulis Adel. It was in the two latter ports, that the Hunters of Ptolemy procured elephants for his army; on the Arabian Coast the harbours most frequented, were Alana or Ezion-gaber, Leuke-kome, where the Romans in the time of Augustus had a garrison, Moosa (Mocha) more than a thousand miles down the Coast, and Ocelies on the Strait of Dira, (Babelmandeb). The latter market in the time of Pliny, was the most celebrated for the merchandize of India, while Moosa was the great entrepôt for the native productions of Arabia; Aden was the ancient centre of traffic between India and the Red Sea. The ships of the East being too large to pass the Straits (Babelmandeb) landed their cargoes here. It was destroyed by the Emperor Claudius with the view of suppressing every power that might interfere with the Roman commerce, and of increasing his revenues from the duties, on the trade of the Gulf which were collected by Plocamus with the garrison stationed at Leuke-kome. In the time of Constantine about A. D. 320 Aden had recovered its commercial celebrity; and being subject to the Empire it got the name of Romanium Emporium; Gése, Sahar (Sohar) the Sachalitis of the Greeks, and Moscha (Muscat) were noted for various native exports, especially incense, and aloes, Gherra, (Katief) was the most celebrated mart on the Persian Gulf. The Gherrians crossed the desert to Petra, Bosra, and Damascus, and were [illegible] the earliest conductors of caravans on the road. We learn from Strabo [illegible] furnished a variety of articles in spices, and aromatics to the Syrians [illegible]icians, who commanded the traffic of Egypt, and the Mediterranean. [illegible]d Memphis also traded with the Arabs, and were celebrated as

mercantile cities, more than a thousand years before the foundation of Alaxendria or Cairo. In the hands of Solomon the traffic of the Red Sea produced a revenue equivalent to three millions and a half (1st Kings x. 14) and at the period when the Romans invaded the East, this lucrative monopoly was exercised by the Sabœns ; whose marts they found richly stored with all the precious commodities of India, and writers both sacred and profane, speak of the valuable and extensive trade of Saba or Yemen. Diodorus considered the happy Arabians so immensely opulent that all the treasures of the world seemed to centre there, as in one universal mart. Agatharcides the first historian worthy of credit, who describes the commerce of Yemen, and its different productions as it stood two hundred years B. C., says at that time, Arabia was the medium of communication between India and Egypt, and it was in her ports, that the Greeks went to purchase their cargoes, before they had ventured to make the distant voyages themselves. Saba he observes abounded with every production that could make life happy. The land yielded not merely the usual commodities ; but balm, cassia, incense, myrrh, and cinnamon were of common growth. The trees wept odorous gums, and the gales were so perfumed with excessive fragrance that the natives were obliged to renew their cloyed senses of pleasure by burning pitch and goat's hair under their noses ; they cooked their victuals with scented woods, living in the careless and delightful enjoyment of those blessings, which conferred on their country the appellation of " Happy ;" in their expensive habits they rivalled the magnificence of princes, their houses were decorated with pillars, glistening with gold and silver, their doors were of ivory crowned with vases, and studded with jewels. The interior of their habitations corresponded with their outward appearance ; in articles of plate, sculpture, in furniture, beds, tripods, and various household embellishments ; they far surpassed any thing that Europeans ever beheld ; other writers Arian, Strabo &c speak in similar terms of the luxury and riches of the Sabœns ; such however is the brilliant picture which the enraptured imagination of foreigners drew of the Happy Arabia ; but truth compels us to avow that the discoveries of modern travellers have drawn aside the veil of romance from this fairy land. They do not find it that paradise of ambroisal felicity, and inexpressible delights, which antiquity represented it. Its real or ideal treasures have vanished, and no Alexander in our times, would dream of making its balmy vales the seat of a mighty empire. The incense, so famous in antiquity, as said to grow in Arabia, we can find no satisfactory account of in ancient authors as regards the production and collection of this celebrated commodity, which was wrapt in such fable and mystery, naturalists were not even certain as to the kind of shrub that produced it, but it is supposed to be a species of amyris or balm tree, so rich in affording gum resins. Theophrastus in his history of plants, says it grew wild in Arabia, on the slopes of the mountains ; and the native writers assert that the districts where it was most common were those of Merbat, Sahar, and Mahrah, and the Greek geographers mention that the native country of incense is Hydramaut.

The mountains of Southern Arabia about Ras-morbat produce incense in great abundance, and I believe the only European who has visited the inland

been all converted to Christianity, and though their notions both of its doctrines and morals were often vague and loose, the change amongst them was marvellous. From the want of roads and thickness of the jungle, and having the advantage of navigable rivers, the inhabitants travelled chiefly in their canoes, and it was a beautiful spectacle to see of an evening the whole of them disembark and draw around the chief man of the fleet, while they knelt in prayer and sung a hymn. As might be expected, many of their original customs still clung to them, amongst which that of tabooing any thing meant to be set aside as sacred, was the most promiment. A tree, a road, a building, or an animal if once tabooed must on no account be touched, and the people were prepared to rise immediately to prevent or avenge interference. The practise of tattooing was getting into disuse, and was nearly extinct amongst the rising generation—the old men were all tattooed and this gave them a look of extreme ferocity—the women merely tattooed their lips, singular practice to render what should be softer than velvet, rough as a file. Many of the New Zealanders who had eaten human flesh in their youth, were now to be found employed under Government, some few were engaged in business, or even shareholders in Banks and Steam Companies. The country every where was in a state of prosperity, progression and promise, the only drawback the want of labour, and I must add, the pugnacious and somewhat indolent habits of the native. This improved state of matters was due almost exclusively to the Missionaries—these had laboured with much prudence and judgment. The British Colonies in Australia were in a state of extraordinary energy and progress. The convict system was now extinct, excepting in the Swan River districts, on the Western side of the Island, where the population was so scanty, that they were glad of convict labour. The city of Sidney, seventy years ago a forest, now contained seventy odd thousand of British population; and the progress of Melbourne was still more remarkable: its imports from 1851 amounted to fourteen millions sterling, and with all these colonies the amount could be little less than twenty millions annually, ten millions worth of gold had of late been sent yearly to Europe, and the wool trade was on the increase notwithstanding. A condition of things, such as this, commanded attention; the Australian colonies were not likely to suffer themselves either to be misgoverned or neglected. The various seats of Government were as distinct from each other as Calcutta, Madras, and Bombay, or even more so, and still more widely separated. Each had its own administration, its own revenue system, and its own Legislative Council. I, continued Col. Jacob, felt curious to see how the business and debates of these little Parliaments were managed, and must say, that the dignity and order observed in that of New South Wales would have done no discredit to Westminster; and made an English feel proud of his country. There were of course discontented spirits and malignants such as prevailed every where, the most conspicuous and troublesome being a Dr. Lang, a Presbyterian Clergyman, who led the democratic faction. But the mass of the people of that colony rate were loyal and contented, devoted to the mother country, and no greater measure of independance than well governed colonists

might enjoy : and the same may be said of the others, with certain large exceptions in Victoria, of which Melbourne is the capital. Every thing in such places as this, especially human labor, was extravagantly dear; common labour could earn ten shillings a day on the roads, and when such a price was paid for breaking stones, the rates of other kinds of industry might be guessed at. The gold diggings had for a time disturbed the whole system of things, and was scarcely more promotive of wealth than injurious to morals. A single anecdote will shew how completely the diggings were a lottery. A small party of men had secured a piece of ground on which they laboured for several months, digging down to the depth of 120 feet. They invested their all in a small steam engine, and pumped and dug and dug and pumped without finding any thing worth notice, until they had exhausted their capital and patience and were induced to abandon the enterprize to go elsewhere and begin the world anew. Some two or three men of lower orders rambling about that way, came upon the just abandoned hole, as such pits are called and resolved to try their luck. In a very short time after commencing work I believe a few hours only, they turned up eight pounds weight of gold in one nugget, worth four thousand pounds sterling. It was actually marked by the scratch of a pickaxe, so nearly had the original excavators realized success when the work was abandoned. Australia would speedily become one of the most magnificent countries in the world, but for its want of rivers,—of these it has but one of any considerable size, the Murree which Capt. Cadel had, he told me, navigated a small steamer on for more than 1,400 miles. Its value remained still to be worked out. There are valuable establishments and farms on the Hunter river, and several other streams, but want of depth far from the mouth. There is considerable steam traffic between many of these and Sydney, and between the latter and Melbourne three large steamers run to and fro weekly. New Zealand and Tasmania have also steam intercourse with the mainland. Although there is great variety of ferns and flowers, the dull green of the one great forest tree—the gum tree—gives monotony to the landscape,—the tree is however useful, one species of the blue gum being preferred to teak for durability; 400 different kinds of wool—mostly divers sorts of gum—were sent from Sydney to the Paris Exhibition, many of them beautifully grained and susceptible of the finest polish. One of the principal trees of New Zealand is called the kawri pines this also appears a species of gum tree, growing to a gigantic size,—at least a kind of gum, called Kawri gum, exudes from it, in exact resemblance to the dripping of a wax candle in the wind. This gum, or rather gum-resin, is in great demand for the manufacture of varnish and other purposes, and it is often found in messes of several pounds weight. The kawri gum of commerce, though clearly the produce of this tree, is dug from the ground in quarters where no traces of forests now exist. [Colonel Jacob here exhibited specimens of both kinds, gathered from the tree and from the ground by himself.] The gum diggers probe the soil with long iron spikes and extract the gum thus indicated from generally a couple of feet below the surface. There can be no doubt that these pieces of gum are the relics of primeval

## Electric Fire-Balls.

I have never happened to see any exhibition of this form of luminous meteor—but from the accounts given of it—it appears in general to be sufficiently distinguishable,—as it is most important that it should be distinguished—from that just described. It seems almost invariably to be concomitant with a violent thunderstorm of the ordinary character, or to be preceded or accompanied by strong electric manifestations in the air—Its motions are at all times slower, much, than those of the meteorite, though it is only when the one actually breaks into fragments, or the other explodes on coming in contact with any imperfect electric conductor, that we have the means of ascertaining positively, the true character of each. There is no reason why a meteorite should not make its appearance, during a thunderstorm as much as during any other state of the weather—but as these bodies are believed to be extramundane, it is opposed to our conceptions of their character that their appearance within our atmosphere, should be in any way affected by any atmospheric commotion. If then it be kept in view how frequently meteors are described as appearing during thunderstorms—and how very small a portion of the whole year, these storms actually occupy, the conclusion seems inevitable, from the undue proportion betwixt the two that the great bulk of what are described as meteors occurring in thunderstorms, are

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planets, probably intersect the orbit of our earth in the same way as Biela's comet does. Upon this view we may imagine these shoot-star asteroids as forming a closed ring, and pursuing their course in the same prticular orbit. The smaller telescopic planets between Mars and Jupiter, with the exception of Pallas, present us, in their closely connected orbits, with a similar relationship. It is impossible as yet to decide whether alterations in the epochs at which the stream becomes visible to us, whether retardations of the phenomenon, to which I long ago directed attention, indicate a regular recession or change of the nodes (the points of intersection of the earth's orbit and the ring) or whether from unequal clustering or very dissimilar distances of the little bodies from each other, the zone is of such considerable breath, that the earth only passes through it in the course of several days. The lunar system of Saturn likewise shows us a group of most intimately associated planetary bodies of amazing breadth. In this group, the orbit of the 7th or outermost satellite, is of so considerable a diameter, that the earth, in her orbit round the sun, would take three days to pass over a space of like extent. Now, if we suppose that the asteroids are unequally distributed in the course of one of the closed rings which we picture to ourselves as forming the orbits of the periodic currents, that there are but a few thickly congregated groups such as would give the idea of continuous streams, we can understand wherefore such brilliant phenomena as those of November 1799 and 1833 are extremely rare. The acute Olbers was inclined to announce the return of the grand spectacle, in which shooting stars mixed with fireballs should fall like a shower of snow, for the 12th—14th of November, 1867.

Hitherto the current of the November asteroids has only been visible over limited portions of the earth's surface. It appeared, for example, with great splendour in England in the year 1837, as a meteoric shower; whilst an ex-ed and very attentive observer at Braunsberg, in Prussia, saw nothing n a few scattered shooting stars in the course of the same night, n o'clock in the evening till sun-rise, the sky having continued un-

simply manifestations of ball lightning. It is singular that a man so industrious and observant as Dr. Purdy Thompson, should have written so indistinctly on a subject, where clearness was of so much importance. In his introduction to meteorology ch. xiii he says :—

"Fire-balls occasionally accompany meteoric stones in their descent; nevertheless, these phenomena must be considered independent, for the boils may appear without the meteorolite, and *vice versa*. Various theories have been proposed to account for them but that which seems to be most tenable assigns their origin to electric agency. Halley conjectured an origin remote from our earth, for, referring to the Bononian meteor of 1676, he observes, that he was 'induced to think that it must be some collection of matter formed in the ether, as it were by some fortuitous concourse of atoms, and that the earth met with it as past along in its orbit.'"

"Priestley takes notice of a fire-ball, said to have been "as large as a millstone," which was seen at sea, in lat. 42° 48, and W. long. 9° 3, from the *Montague*, on the 4th November 1749; it broke with a violent crash, the main top-mast being at the same moment shattered, and strong sulphureous smell perceived; five seamen were thrown down, and one much hurt. We are disposed to class this meteor, which was seen rolling upon the sea like a large blue ball, with ascending thunderbolts, rather than with fire-balls.

"Three are recorded in the following year by Mr. Bennet :*—one of them occurred in July, during a thunderstorm, which was as big as a man's head, and fell into the ocean near the ship : the second was on the 7th September,

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interruptedly clear the whole of the time. Bessel concluded from this, "that a group of the great ring wihich is occupied by these bodies, of but limited extent, had appproached the earth over England, whilst districts to the east passed through a relatively empty portion of the ring" (46). Should the idea of a regular precession or variation of the nodal lines, occasioned by perturbations, acquire greater likelihood, the discovery of older observations of the phenomenon would become a matter of particular interest. The Chinese annals, in which, beside the appearance of comets, there are also notices of great showers of shooting stars, go back beyond the time of Tyrtæus, or the second Messenic war. They describe two streams occurring in the month of March, one of which is 687 years older than the commencement of the Christian era. Edward Biot has already remarked, that among the fifty-two appearances which he finds recorded in the Chinese annals, the most frequently recurring were those that fell near the date from the 20th to the 22d of July (old style), which may very possibly be the now advanced stream occurring about the time of the feast of St. Lawrence (47). If the great fall of shooting stars which Bogulawski, jun., finds recorded in Benessius de Horowic's "Chronicon Ecclesiæ Pragensis," as having been seen in full day light on the 21st of October, 1366 (old style), corresponds with our present November fall, the precession in the course of 447 years informs us that this shoot-stars system (that is to say, its common point of gravity), describes a retrograde course about the sun. It also follows, from the views now developed, that when seasons pass by in which neither of the streams as yet observed—that, namely, of November and that of August,—is seen in any part of the earth, the reason of this lies either in the interruption of the ring—in other words, in the occurrence of gaps or vacancies between the clusters of asteroids that follow each other, or, as Poisson will have it, in the influence which the larger planets exercise upon the form and position of the ring (48)."

* Voy. and Trav. vol. i. pp. 23, 46 54.

East of the Village of Parnallee, Latitude north, according to the Government Map, 9° 14', Longitude 78° 21' East.

The largest one fell a few seconds before the smaller one, and from two to three miles North of it. As was manifest from the hole it made in the ground when it fell it came from a direction some ten degrees West of North, making an angle of about 15 or 20 degrees with a line perpendicular to the earth's surface. It struck the earth, (or at least lay in the bottom of the hole made by it) flatwise, on the side that is most convex. The most round or convex side of the smaller stone also was downward, this being the position they would naturally assume as they passed with great velocity, through the resisting atmosphere, an idea which did not occur to me till now. I had before simply noted the fact. The larger stone sank into the earth when it fell two feet and five inches in a perpendicular direction. The smaller one about two feet and eight inches. The smaller one fell also about perpendicularly. The smaller does not appear in any respect like a fragment of the larger one. The specific gravity of the smaller one when it fell was about 3.3, water being the standard of unity. I observed that the specific gravity was increased after exposure to a shower, or rather that of the smaller one was. I did not try that of the larger. The crack on the convex side of the larger one I did not perceive at all till it had been wet, and then at first it was but just perceptible. Afterwards it gradually opened, I suppose owing to the oxidation of the native iron it contains, perhaps however to other causes. The stone had not been wet till they came into my hands April 21st. They each of them fell in cultivated fields, one of which had been harvested. The straw in the other was still standing.

The *noise* seems to have been terrific to the Natives, causing those near to crouch from fear. It came like two claps of thunder, as they fell one after the other, and continuing for some time, but gradually growing less loud. As they fell through the whole depth of our atmosphere this would naturally be the case. The noise appears to have been heard at Tuticorin forty miles distant. At this place, sixteen miles North, it excited considerable interest among those abroad at the time. The noise must have been great, occasioned by their great velocity. Taking their specific gravity into the account, say 3.3, their size being about that of large cannon balls, some allowance also being made for their irregular shape, from the depth they penetrated the soil, which was of about common hardness, those who have observed the power of projectiles in such cases, will be able to calculate, approximately, what that velocity was.

Of the excitement among the Natives I suppose I need not speak. I visited the place because of the rumours that were flying abroad, making it evident to my mind that some thing peculiar had there transpired. First I saw the holes from which, in the cultivated fields they had been freshly taken, no rain having subsequently fallen, and saw at the bottom the *hardly compressed*, and exact impression left by them as they were taken up, and then as soon as I saw the stones, I knew instantly they were the identical ones which had been taken up from those places. As I was more or less known in that region, and there is no gentleman whatever any where near, the rural people, utterly ignorant of the cause, came in great numbers to state the facts and ask some explanation. Some of them supposed they were gods that had fallen, some that they had been shot from cannon on ships at Tuticorin, and some that a Brahmin had brought them from the sea by his Munterums. Some rejected all these theories, but no one could tell or feel satisfied as to how these things could be. By simply striking my staff through the air I could explain to them the noise; and by tying a stone to a string and swinging it, I could make them understand the centrifugal and centripetal forces, and how that from some disturbance in these forces,

of these bodies was heard distinctly at Tuticorin 40 miles off and in all the surrounding villages.

The subject appears to me an interesting one for scientific enquiries, and this is my chie reason for requesting you to have the goodness to cause its insertion in the columns of you paper.

I am, Sir,
Your obedient servant,
J. COLEBROOKE,
*Zillah Surgeon, Madura,*

\, 9*th April* 1857.—*Athenæum.*

stones moving about some centre like the Moon about the Earth, might fall. The explanations gave them relief. They put confidence in me, and gave me the stones at my request, that I might save them from the trouble of any official investigation, and put them into some Museum or Scientific Institution.

P. S.—I forgot to say that there was nothing peculiar in the state of the atmosphere. It was a clear day. When the stone is sent on to Madras, if any scientific Gentleman makes an analysis of it, for the Museum, please be so good as to ask a copy of it for me.

METEORITES IN THE DESERT.—A piece of meteoric iron was some weeks since picked up in the desert at the last horsing station, about ten miles from Suez by Dr. Buist. It weighs thirty ounces avoirdupois, and is of an irregularly spherical form, something like an illformed cannon shot. A characteristic which pointed out its meteoric origin was its honey-combing all over the surface, indicating its having been in a molten state without having been in a mould. It was found too hard to cut with a file or saw, or to turn; and being split in two with a chisel, it was found of a lightish grey colour, full of small air-holes, and beautifully radiated from the centre outwards, with a crystalline texture like that of antimony. It still remains to be examined chimically. The finder was on the outlook for Egyptian jaspers, and seeing one darker than the rest, picked it up, and to his astonishment found it a meteorite. As it is considerably less in size than the majority of those with which we are familiar, it is not improbable that other fragments may exist in the neighbourhood; and future passengers, curious in such things, might do well to be on the look-out for them. The railway will three months hence cause the station-houses to be forgotten. Unless for the accident of fragments, the chances are myriads against one, against a rarity of this kind being found; and a wild tract strewed thick with stones like the desert, may be searched for centuries without any thing of this kind again occurring.—*Bombay Times, Oct.* 10 1857.

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# APPENDIX C.

## EARTHQUAKES.

EARTHQUAKE IN TRAVENCORE.—SIR,—Perhaps the following account of the Earthquake observed in Travencore on the morning of Monday the 11th instant may interest some of your readers.

The assistant in the Trevandrum observatory having the watch on the morning referred to was entering an observation when he heard a low rumbling sound which he thought at first was distant thunder towards the North-East; in about three seconds the rafters of the building began to creak, the windows to rattle and a mirror resting on the table to shake: he immediately looked at the clock and found the time 5h. 53m. 30s. which, allowing for the known clock error, would give the mean Trevandrum time of the commencement of the sound 5h. 51m. 25s. He then went out to look towards the North-East and immediately thereafter the sound ceased with a louder "bom;" on looking again at the clock the time by it was 5h. 54m. and he estimated the duration of noise and shock at nearly twenty seconds. He now examined the magnetical instruments, but could perceive neither vibration nor change of mean position. It is not impossible however that the magnets might have had swinging or dancing motions without being remarked by the observer, as vibrations round a verticle axis only are noticed. An examination by myself since, of the observations made before and after the shock, confirms the fact of the steadiness of all the magnets, neither did I find any thing remarkable in the state of the atmosphere. The velocity of the wind from the North-west was rarely as usual at the same hour; the sky was nine-tenths clouded, the clouds moving from North-west; the temperature of the air was nearly 73°. the maximum temperature of the day being nearly 78°.

A Lady living near the observatory was awoke by a low rumbling, puffing noise, which terminated by a stifled explosion, as if under ground, she saw the

foot of the bed moving slightly from side to side (north and south) and heard the windows rattle. The sound seemed to her to precede the shaking by a few seconds, but she did not conceive that the whole lasted more than from five to ten seconds. The air appeared hazy to her and to several other persons. The atmosphere felt close and disagreeable during the day.

Lieut. Col. Faunce, living about three-quarters of a mile west of the observatory, has informed me, that the noise and shock appeared to him to come from the south east and to proceed in a north-westerly direction: the noise seemed in or on the surface of the ground and the noise and shock lasted at least six or seven seconds. The shock was rather strong, his right leg was swayed from right to left (i. e. east to west) while he was sitting facing the north and his body felt the movement. Col. Faunce also thinks that the sound preceded the shock. The windows rattled considerably. He likened the noise to that of a steam carriage; a rumbling sound terminating louder than it commenced.

Dr. Sperschneider, three quarters of a mile north west of the observatory, also felt the shock. The noise he says began a few seconds before the earthquake and lasted a few seconds after it. It appeared to Dr. Sperschneider to go off in a westerly or northwesterly direction; the windows and roof of his house trembled.

Dr. Waring, about a mile and half north of the observatory, heard and felt the earthquake though apparently not so markedly as by the others. I am told that about the same distance south, southeast of the observatory the shock was very distant; while within the Fort about two miles south of the observatory the earthquake was not perceived at all. It should be noted that about the Fort decomposed granitic rocks are covered by a thick stratum of sand, while all the other stations are immediately on laterite rock.

The shock it seems was felt at Quilon "about six o'clock" and Mr. Liddell at Charlie's Hope near the road between Quilon and Courtallum says "we had a smart shock of an earthquake about ten minutes before six on Monday morning."

I was on the summit of our highest mountains, the Agusteer Mally (about 30 miles W. N. W. of Trevandrum) on Monday the 11th but did not perceive any shock. I noted that the Tinnevelley country and the mountains to the north appeared much clearer that morning than usual.

The testimony on the whole seems to indicate a southerly and easterly point as the direction of the origin, all agree that the sound was heard before the shock was perceived. It is quite possible that the shock may have been propagated from Tinnevelly below the ghats and not have been very sensible at their summits. It would be of importance for the purpose of determining the origin, the velocities and the direction of transmission of the shock to have the accurate time it was perceived at some localities considerably distant from Trevandrum.

I have the honor to be, Sir,
Yours obediently,
JOHN ALLAN BROWN.

Trevandrum Observatory
16th August 1856.

P. S. Where the earthquake has been observed it will be desirable to mention by what means the error of the timepiece has been obtained.—*Athenæum, August* 23.

SECOND SHOCK OF EARTHQUAKE IN TRAVENCORE.—SIR,—I took the liberty a few days ago of forwarding to you a notice of an earthquake felt in Travancore on the 11th Instant, allow me to add to that communication that I have found since that the shock was neither perceived at Nagercoil (40 miles S. E. by E. of Travendrum) nor at Cochin (120 miles N. W. by N.) but I understand it was felt at Cottyam (90 miles N. E.) by several persons; and Dr. Barker estimates the time of the shock there at 5h 50m A. M. (verified to some degree by the sunrise) this time agrees really with that of the shock at Trevandrum. At Quilon Mr. D'Albedhyll informs me that two ladies give 20 minutes before 6 as the time of shock. On the best consideration of all the facts as yet received by me I